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TRANSACTIONS

OF THE

AMERICAN PEDIATRIC SOCIETY

THIRTIETH SESSION

HELD AT THE CURTIS HOTEL, LENOX, MASS.
MAY 27, 28 AND 29, 1918

EDITED BY

OSCAR M. SCHLOSS, M.D.

VOLUME XXX

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PRESIDENTS

1889. A. Jacobi, M.D.
1890. J. Lewis Smith, M.D.
1891. T. M. Rotch, M.D.
1892. William Osler, M.D.
1893. A. D. Blackader, M.D.
1894. John M. Keating, M.D.
1895. F. Forchheimer, M.D.
1896. Joseph O'Dwyer, M.D.
1897. Samuel S. Adams, M.D.
1898. L. Emmett Holt, M.D.
1899. William P. Northrup, M.D.
1900. Henry Koplik, M.D.
1901. William D. Booker, M.D.
1902. W. S. Christopher, M.D.
1903. J. P. Crozer Griffith, M.D.
1904. Augustus Caillé, M.D.
1905. C. G. Jennings, M.D.
1906. A. Jacobi, M.D.
1907. B. K. Rachford, M.D.
1908. C. G. Kerley, M.D.
1909. Charles P. Putnam, M.D.
1910. David L. Edsall, M.D.
1911. Henry Dwight Chapin, M.D.
1912. Walter Lester Carr, M.D.
1913. John Lovett Morse, M.D.
1914. Samuel McC. Hamill, M.D.
1915. George N. Acker, M.D.
1916. Rowland G. Freeman, M.D.
1917. Frank Spooner Churchill, M.D.
1918. Linnaus E. La Fétra, M.D.

OFFICERS, 1918

President.....L. E. La Fétra, M.D.
Vice-President.....H. M. McClanahan, M.D.
Secretary.....Howard C. Carpenter, M.D.
Treasurer.....Charles Hunter Dunn, M.D.
Recorder and Editor.....Oscar M. Schloss, M.D.
Delegate to Congress of American Physicians and Surgeons.....J. P. Crozer Griffith, M.D.
Alternate Delegate to Congress of American Phys. and Surgs....Samuel S. Adams, M.D.

COUNCIL, 1918

John Howland, M.D., *Chairman*

Fritz B. Talbot, M.D.
D. M. Cowie, M.D.
L. Emmett Holt, M.D.
Charles A. Fife, M.D.
Royal S. Haynes, M.D.
Julius P. Sedgwick, M.D.

MEETING PLACES

1888. Washington, D. C. (Organization), September 18.
1889. Washington and Baltimore, September 20 and 21.
1890. New York, June 3 and 4.
1891. Washington, September 22 and 25.
1892. Boston, May 2, 3 and 4.
1893. West Point, N. Y., May 24, 25 and 26.
1894. Washington, May 29 and June 1.
1895. Virginia Hot Springs, May 27, 28 and 29.
1896. Montreal, May 25, 26 and 27.
1897. Washington, May 4, 5 and 6.
1898. Cincinnati, June 1, 2 and 3.
1899. Deer Park, June 27, 28 and 29.
1900. Washington, May 1, 2 and 3.
1901. Niagara Falls, May 27, 28 and 29.
1902. Boston, May 26, 27 and 28.
1903. Washington, May 12, 13 and 14.
1904. Detroit, May 30, 31 and June 1.

1905. Lake George, N. Y., June 19, 20 and 21.
1906. Atlantic City, N. J., May 30, 31 and June 1.
1907. Washington, May 7, 8 and 9.
1908. Delaware Water Gap, May 25, 26 and 27.
1909. Lenox, Mass., May 27 and 28.
1910. Washington, May 3, 4 and 5.
1911. Lake Mohonk, N. Y., May 31 and June 1 and 2.
1912. Hot Springs, Va., May 29, 30 and 31.
1913. Washington, May 5, 6 and 7.
1914. Stockbridge, Mass., May 26, 27 and 28.
1915. Lakewood, N. J., May 24, 25 and 26.
1916. Washington, May 8, 9 and 10.
1917. White Sulphur Springs, W. Va., May 28, 29 and 30.
1918. Lenox, Mass., May 27, 28 and 29.
1919. Atlantic City, N. J.

OFFICERS, 1919

President.....Edwin E. Graham, M.D.
Vice-President.....Henry Heiman, M.D.
Secretary.....Howard Childs Carpenter, M.D.
Treasurer.....Charles Hunter Dunn, M.D.
Editor and Recorder.....Oscar M. Schloss, M.D.
Member of Committee on Arrangements of the Congress of American Physicians and Surgeons...Samuel S. Adams, M.D.
Alternate.....George H. Acker, M.D.

COUNCIL

Fritz B. Talbot, M.D., *Chairman*

D. M. Cowie, M.D.
L. Emmett Holt, M.D.
Charles A. Fife, M.D.
Royal S. Haynes, M.D.
Julius P. Sedgwick, M.D.
Isaac A. Abt, M.D.

MEMBERS

1903. Abt, Isaac A., M.D.....4810 Kenwood Avenue, Chicago
1893. Acker, George N., M.D.....913 Sixteenth Street, Washington
O Adams, Samuel S., M.D.....1801 Connecticut Ave., N.W., Washington
1916. Bartlett, Frederic H., M.D.....44 East Sixty-Third Street, New York
O Blackader, A. D., M.D.....236 Mountain Street, Montreal
1916. Blackfan, Kenneth D., M.D.....Johns Hopkins Hospital, Baltimore
1911. Bowditch, Henry I., M.D.....416 Marlborough Street, Boston
1918. Brennemann, Joseph, M.D.....309 East Forty-Seventh Street, Chicago
1911. Butterworth, William W., M.D..3914 Prytania Street, New Orleans, La.
O Caillé, Augustus, M.D.....753 Madison Avenue, New York
1911. Carpenter, Howard C., M.D.....1805 Spruce Street, Philadelphia
O Carr, Walter Lester, M.D.....68 West Fifty-First Street, New York
O Chapin, Henry Dwight, M.D....51 West Fifty-First Street, New York
1897. Churchill, F. S., M.D.....1259 North State Street, Chicago
1909. Cowie, D. M., M.D.....Lawrence Building, Ann Arbor, Mich.
1891. Crandall, Floyd M., M.D.....113 West Ninety-Fifth Street, New York
1917. De Buys, L. R., M.D.....921 Canal Street, New Orleans, La.
O Dorning, John, M.D.....124 West Eighty-First Street, New York
1906. Dunn, Charles Hunter, M.D.....178 Marlborough Street, Boston
1904. Eaton, Percival J., M.D.....715 N. Highland Avenue, E.E., Pittsburgh
1907. Fife, Charles A., M.D.....2033 Locust Street, Philadelphia

1918. Fleischner, E. C., M.D.....848 Gough Street, San Francisco
1895. Freeman, Rowland G., M.D...211 West Fifty-Seventh Street, New York
1913. Friedlander, Alfred, M.D.....4 West Seventh Street, Cincinnati
1913. Gerstenberger, Henry J., M.D.....Osborn Building, Cleveland
1910. Gittings, J. C., M.D.....3492 Chestnut Street, Philadelphia
1897. Graham, E. E., M.D.....1713 Spruce Street, Philadelphia
1892. Griffith, J. P. Crozer, M.D.....1810 Spruce Street, Philadelphia
1917. Grulee, Clifford, M.D.....1324 Madison Park, Chicago
1898. Hamill, S. McC., M.D.....1822 Spruce Street, Philadelphia
1902. Hand, Alfred, Jr., M.D.....1724 Pine Street, Philadelphia
1910. Haynes, Royal S., M.D.....213 West Seventieth Street, New York
1909. Heiman, Henry, M.D.....64 West Eighty-Fifth Street, New York
1914. Helmholz, Henry F., M.D.....1005 Michigan Avenue, Evanston, Ill.
1910. Herrman, Charles, M.D.....250 West Eighty-Sixth Street, New York
1915. Hess, Alfred F., M.D.....16 West Eighty-Sixth Street, New York
O Holt, L. Emmett, M.D.....14 West Fifty-Fifth Street, New York
1913. Hoobler, B. Raymond, M.D.....1563 David Whitney Building, Detroit
1905. Howland, John, M.D.....20 East Eager Street, Baltimore
O Jacobi, A., M.D.....19 East Forty-Seventh Street, New York
1918. Jeans, Philip C., M.D..Washington University Medical School, St. Louis
1896. Kerley, Charles G., M.D.....132 West Eighty-First Street, New York
1905. Knox, J. H. Mason, Jr., M.D.....“The Severn,” Baltimore
O Koplik, Henry, M.D.....30 East Sixty-Second Street, New York
1903. Ladd, Maynard, M.D.....270 Clarendon Street, Boston
1903. La Fétra, Linnaeus E., M.D.....113 East Sixty-First Street, New York
1911. Lucas, William Palmer, M.D..University of California, San Francisco
1912. McClanahan, H. M., M.D.....468 Brandeis Building, Omaha
1909. Machell, H. T., M.D.....216 St. Clair Avenue, Toronto
1917. Marriott, W. McKim, M.D.....Washington University, St. Louis
1898. Miller, D. J. Milton, M.D....127 S. Illinois Avenue, Atlantic City, N. J.
1918. Mitchell, A. Graeme, M.D.....1805 Pine Street, Philadelphia
1896. Morse, J. Lovett, M.D.....70 Bay State Road, Boston
O Northrup, William P., M.D..57 East Seventy-Ninth Street, New York
1915. Park, Edwards A., M.D.....Johns Hopkins Hospital, Baltimore
1910. Pisek, Godfrey R., M.D.....26 East Sixty-Fourth Street, New York
1912. Porter, R. Langley, M.D.....240 Stockton Street, San Francisco
1891. Rachford, B. K., M.D.....1961 Madison Road, Cincinnati
1917. Ramsey, Walter R., M.D.....942 Lowry Building, St. Paul, Minn.
1905. Ruhräh, John, M.D.....11 Chase Street, Baltimore
1900. Saunders, E. W., M.D.....3003 Lafayette Avenue, St. Louis
1912. Schloss, Oscar M., M.D....172 West Seventy-Ninth Street, New York
1917. Schlutz, F. W., M.D.....820 Donaldson Building, Minneapolis
1913. Sedgwick, Julius P., M.D.....2015 Kenwood Parkway, Minneapolis
1902. Shaw, Henry L. K., M.D.....361 State Street, Albany
1914. Sherman, DeWitt H., M.D.....680 West Ferry Street, Buffalo
1915. Smith, Richard M., M.D.....329 Beacon Street, Boston
1891. Snow, Irving M., M.D.....737 Delaware Avenue, Buffalo
1905. Southworth, Thomas, S., M.D.....807 Madison Avenue, New York
1911. Talbot, Fritz B., MD.....311 Beacon Street, Boston
1910. Tileston, Wilder, M.D.....424 Temple Street, New Haven
1914. Van Ingen, Philip, M.D....125 East Seventy-First Street, New York
1912. Veeder, Borden S., M.D.....500 South Kingshighway, St. Louis
1914. Walls, Frank X., M.D....1208, 30 North Michigan Boulevard, Chicago
1896. Westcott, Thompson S., M.D.....1720 Pine Street, Philadelphia
1913. Wilcox, Herbert B., M.D.....159 East Seventieth Street, New York
O Winters, J. E., M.D.....25 West Thirty-Seventh Street, New York

Note.—The first column gives the date of election to the Society. The organizers of the Society are designated by “O,” the date being 1888.

HONORARY MEMBERS

Dr. John Thompson.....Edinburgh, Scotland
Dr. George F. Still.....London, England
Dr. William Osler.....Oxford, England
Dr. V. Hutinel.....Paris, France
Dr. Charles Rauchfuss.....Petrograd, Russia

EMERITUS MEMBERS

Dr. Allen Baines.....Toronto
Dr. Floyd M. Crandall.....New York
Dr. John Dorning.....New York
Dr. Francis Huber.....New York

Deceased

JOHN A. JEFFRIES, M.D.
Born, September 2, 1859,
Died, March 26, 1892.

THOMAS F. SHERMAN, M.D.
Born, March 17, 1856,
Died, September 26, 1893.

JOHN M. KEATING, M.D.
Born, April 20, 1852,
Died, November 17, 1893.

CHARLES WARRINGTON EARLE, M.D.
Born, 1845,
Died, November 19, 1893.

J. LEWIS SMITH, M.D.
Born, October 15, 1827
Died, June 9, 1897.

JOSEPH O'DWYER, M.D.
Born, October 12, 1841.
Died, January 7, 1898.

JOHN HENRY FRUITNIGHT, M.D.
Born, November 9, 1851,
Died, December 18, 1900.

FREDERICK A. PACKARD, M.D.
Born, November 17, 1862,
Died, November 1, 1902.

WALTER S. CHRISTOPHER, M.D.
Born, 1859,
Died, March 2, 1905.

LEROY MILTON YALE, M.D.
Born, February 12, 1841,
Died, September 12, 1906.

JAMES PARK WEST, M.D.
Born, June 27, 1858,
Died, June 25, 1908.

FREDERICK FORCHHEIMER, M.D.
Born, 1853,
Died, June 1, 1913.

THOMAS MORGAN ROTCH, M.D.
Born, 1850,
Died, March 9, 1914.

CHARLES P. PUTNAM, M.D.
Born, 1845,
Died, April 22, 1914.

HENRY LEBER COIT, M.D.
Born, 1854,
Died, March 13, 1917.

CONSTITUTION AND BY-LAWS OF THE AMERICAN PEDIATRIC SOCIETY

ARTICLE 1

Name and Object of the Society

The Society shall be known as the American Pediatric Society, and shall hold an annual meeting.

It has for its object the advancement of the knowledge of physiology, pathology and therapeutics of infancy and childhood.

ARTICLE II

Proceedings

The proceedings shall consist of:

1. Discussions on subjects previously selected.
2. Original communications.
3. Demonstrations of gross and microscopic preparations, apparatus, and instruments.

ARTICLE III

Members

The Society shall be composed of three classes of members to be designated: (1) active members; (2) emeritus members, and (3) honorary members.

The number of active members shall be limited to seventy-five.

The number of emeritus members shall be unlimited.

The number of honorary members shall be limited to twenty-five.

ARTICLE IV

Election of Active Members

Nominations to membership, signed by two members of the Society, must be made in writing at least one meeting prior to election.

Nomination should be made to the Secretary, whose duty it shall be to require the nominators to write a personal letter endorsing and stating the qualifications of the nominee, and at the same time furnishing a list of the nominee's professional position and publications, with reprints of the latter, when obtainable.

It shall be the duty of the Secretary to transmit to the Chairman of the Council all the above papers pertaining to each nominee, at least three months prior to his possible election.*

The Chairman of the Council shall transmit the above-named papers to the other members of the Council in the order of their seniority as Council members, the junior members of the Council returning them to the Secretary.

It shall also be the duty of the Secretary to furnish a printed list of all nominees at least once a year to every member of the Society, and it shall be the duty of the members of the Society, without solicitation, to furnish the Council with any information that they may possess as to the fitness of the nominees to become members of the Society.

On nomination by the Council, members shall be elected by the Society by ballot. A two-thirds vote of the members present shall be necessary for election.

ARTICLE V

Election of Emeritus and Honorary Members

Active members who have served fifteen years and have paid all their dues, may on their request and on the recommendation of the Council be made emeritus members. They shall be entitled to attend meetings and read papers, when they so desire, but cannot vote.

Physicians of sufficient eminence to merit the distinction may be elected honorary members, to a number not exceeding twenty-five. Such members shall be entitled to attend all meetings and take part in the proceedings, but cannot vote. Honorary members shall be elected in the same way as active members.

ARTICLE VI

Initiation Fee and Annual Dues

Election to membership shall be completed by the payment of an initiation fee of $10.

Each active member shall pay an annual fee, the amount of which shall be decided at each annual meeting.

Emeritus and honorary members shall be exempt from fees.

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* In the event that required information relating to candidates for membership is not furnished to the Secretary by three months before the time of the meeting at which they would be considered, such candidates for election shall be held over for another year. (Resolution adopted 1912.)

ARTICLE VII

Officers

The officers shall consist of a President, Vice-President, Secretary, Recorder [and Editor], Treasurer and a Delegate to the Congress of Physicians and Surgeons.

The officers shall be elected annually on nomination by the Council.

ARTICLE VIII

Duties of Officers

The duties of the President, Vice-President, Secretary and Treasurer shall be those usual to these offices. The Recorder [and Editor] shall secure the papers read and see that proper notes are taken of the discussion thereon for the use of the committee on publication.

ARTICLE IX

The Council

The Council shall consist of seven members, the senior member being Chairman. One member of the Council shall be elected each year. Four members shall constitute a quorum. The senior member shall retire at the end of each year and shall not be immediately eligible to reelection.

ARTICLE X

Duties of Council

The duties of the Council shall be to consider nominations for membership and report them to the Society. The votes of four members of the Council shall be required for nomination. The Council shall also nominate the officers of the Society and shall decide the time and place of meeting.

ARTICLE XI

Committee of Arrangements

The President, Secretary and the Chairman of the Council shall constitute a commtitee of arrangements, the President being chairman of this committee. They shall arrange the details of the meeting and the preparation of the program, and they shall have the authority to invite guests to attend the meeting and to participate in the discussion.

ARTICLE XII

Publication Committee

The Secretary, Treasurer and Recorder shall constitute a committee on publication, to which shall be referred all papers, reports and other matters intended for publication.

All papers presented shall become the property of the Society.

ARTICLE XIII

Amendments of Constitution and By-Laws

Proposals for amendments of the constitution and by-laws must have been made at the meeting previous to that at which they are voted on, the notice for which shall contain an announcement of the proposed changes. Such changes shall require, for their adoption, an affirmative vote of three-fourths of the active members present.

ARTICLE XIV

Termination of Membership

A member may be expelled from the Society for conduct unbecoming a physician and a gentleman. In such cases, formal charges must be made in writing by two members, which shall be referred to the Council.

Active membership shall lapse for any one of the following reasons:

(1) Absence from three consecutive meetings without excuse acceptable to the council; (2) failure to present and read a paper for five consecutive years; the Secretary in both these cases shall notify members one year before date of possible lapse; (3) non-payment of dues for two years, two notifications having been sent by the Treasurer.

ARTICLE XV

Quorum

Any number of members present at the appointed time of the annual meeting shall constitute a quorum for the transaction of ordinary business, but for the election of members, fifteen shall be necessary for a quorum; and for the expulsion of members, or for altering the constitution and by-laws, twenty-five members shall be necessary.

ARTICLE XVI

Order of Business

1. The President shall call the meeting to order and deliver an annual address. In his absence the Vice-President shall preside, and in the absence of all these officers, the Chairman of the Council.

2. When a general discussion is arranged by the Council, the two members appointed to open the discussion shall not occupy more than twenty minutes each; subsequent speakers shall be restricted to ten minutes each.

3. Papers shall not exceed fifteen minutes in the reading. In the discussion following the reading of such papers, remarks shall be limited to five minutes. Should any paper be too long to read in fifteen minutes, the writer must prepare an abstract which can be read within that time.*

4. At the business session the report of the Council as a committee on nominations to office and to membership, shall be made, and ballot shall be held thereon.

Adopted May 28, 1900.

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*In order to expedite the publication of the Transactions, all members whose papers are to appear in the volume, be required either to have their articles in the hands of the editor before July 1 or to have them in process of publication in some medical journal by that date. In the latter event, the editor of the Transactions is to be notified what journal will publish the paper and reprints or galley proofs are to the furnished to him as soon as possible. (Resolution adopted, 1912.)

MEMBERS OF THE AMERICAN PEDIATRIC SOCIETY PRESENT AT LENOX MEETING, 1918.

MINUTES OF THE THIRTIETH ANNUAL MEETING OF THE AMERICAN PEDIATRIC SOCIETY

Held at the Curtis Hotel, Lenox, Massachusetts, May 27, 28 and 29, 1918

The meeting was called to order at 11:15 a. m. by the President, Dr. Linnaeus Edford La Fétra of New York City.

The following members were present during the sessions: Drs. Isaac A. Abt, Chicago; Samuel S. Adams, Washington; Howard Childs Carpenter, Philadelphia; Augustus Caillé, New York; Walter Lester Carr, New York; Henry Dwight Chapin, New York; Frank Spooner Churchill, Chicago; D. M. Cowie, Ann Arbor; L. R. DeBuys, New Orleans; Charles Hunter Dunn, Boston; Percival J. Eaton, Pittsburgh; Rowland G. Freeman, New York; Edwin E. Graham, Philadelphia; J. P. Crozer Griffith, Philadelphia; Royal S. Haynes, New York; S. McC. Hamill, Philadelphia; Alfred Hand, Jr., Philadelphia; Henry Heiman, New York; Henry F. Helmholz, Evanston, Ill.; Charles Herrman, New York; Alfred F. Hess, New York; L. Emmett Holt, New York; John Howland, Baltimore; Charles G. Kerley, New York; Henry Koplik, New York; L. E. La Fétra, New York; William Palmer Lucas, San Francisco; H. M. McClanahan, Omaha; W. McKim Marriott, St. Louis; J. Lovett Morse, Boston; William P. Northrup, New York; Godfrey E. Pisek, New York; R. Langley Porter, San Francisco; Walter R. Ramsey, St. Paul; E. W. Saunders, St. Louis; Oscar M. Schloss, New York; Frederic W. Schlutz, Minneapolis; Julius P. Sedgwick, Minneapolis; DeWitt H. Sherman, Buffalo; Richard M. Smith, Boston; Irving M. Snow, Buffalo; Thomas S. Southworth, New York; Fritz B. Talbot, Boston; Wilder Tileston, New Haven; Frank X. Walls, Chicago; Herbert B. Wilcox, New York, and J. E. Winters, New York.

In addition to the members, the following guests were introduced: Drs. Harold Ruckman Mixsell, New York City; Jesse F. Sammis, New York City; Paul Armand De Lille, Paris, France; Charles Hendee Smith, New York City; Edgar J. Huenekens, Minneapolis; Albert H. Byfield, Iowa City; E. W. Murray, Newark, N. J.; Major

Henry T. Price, Pittsburgh; Thomas B. Cooley, Detroit; Harold J. Morgan, Toledo; Max Seham, University of Minnesota; C. F. Gelston, San Francisco; Jay I. Durand, Seattle; George Pratt Hunt, Pittsfield; William Leroy Paddock, Pittsfield; Henry Colt, Pittsfield; W. A. Mulherin, Augusta, and Max Lane, East Orange, N. J.

The minutes of the Twenty-Ninth Annual meeting, as published in the Transactions of the Society, were approved.

The following papers were presented:

1. Dr. L. E. La Fétra, Presidential Address, on the subject, "The Neglected Period of Childhood."

2. Dr. Augustus Caillé: "Hemoptysis Following Exploratory Puncture of the Chest."

3. Dr. Isaac A. Abt: "Breath Holding in Children."

The paper was discussed by Drs. Freeman, Eaton, Heiman, Herrman Abt, and La Fétra.

4. Dr. John Howland: "Death from Cardiac Failure in Children, Unexplained by Postmortem Examination."

The paper was discussed by Drs. Dunn, Morse, Carpenter, Pisek and Howland.

5. Dr. J. P. Crozer Griffith: "Infantilism, with Reports of Two Cases Illustrating the Brissaud and Fröhlich Types, Respectively."

The paper was discussed by Drs. Herrman and Griffith.

Dr. Charles Herrman: "Head Shaking with Nystagmus in Infants."

The paper was discussed by Drs. Caillé and Herrman.

7. Dr. W. McKim Marriott and Warren R. Sisson, M.D.: "Variations in Lipoid ('Fat') Content of the Blood of Infants under Certain Nutritional Conditions."

The paper was discussed by Drs. Dunn, Talbot, Helmholz and Marriott.

8. Dr. Walter E. Ramsey: "The Relative Efficiency of the Different Mercurial Preparations in the Treatment of Congenital Syphilis as Determined by a Quantitative Estimate of the Elimination of Mercury in the Urine."

The paper was discussed by Drs. Carpenter and Ramsey.

9. Dr. L. Emmett Holt: "Standards for Growth in Children."

The paper was discussed by Drs. La Fétra, Talbot, Pisek, Morse, Griffith, Hess, DeBuys, Smith and Holt.

10. Dr. Henry Heiman: "The Complement Fixation Test for Tuberculosis in Infancy and Childhood."

The paper was discussed by Drs. De Lille, Sedgwick and Heiman.

11. Dr. Charles G. Kerley: "Twenty-Six Cases of Pyloric Stenosis in Private Practice, with Operation."

The paper was discussed by Drs. Holt, Howland, Hess, Chapin, Heiman, Ramsey, Helmholz, McClanahan, Griffith, Morse, Schloss, Pisek, Cowie and Kerley.

12. Dr. E. W. Saunders: "A Preliminary Report upon the Value of Auxohormones, and Other Agents in the Feeding of the Young."

13. Major Henry T. Price: "The Appeal of the Medical Reserve Corps to the American Pediatric Society."

14. Col. Channing Frothingham: "Appeal of the Medical Reserve Corps to the American Pediatric Society."

15. Dr. John Howland: "A Case of Erosion of Blood Vessels in the Course of Scarlet Fever."

The paper was discussed by Dr. Carpenter.

16. Dr. Walter Lester Carr: "A Case of Hirschsprung's Disease."

The paper was discussed by Drs. Koplik, Howland, Talbot, Kerley, Heiman, Porter, Dunn and Morse.

17. Dr. H. M. McClanahan: "A Brief Report of an Infant with Congenital Stricture of the Duodenum: Operation, Death."

The paper was discussed by Drs. Talbot, Porter and La Fétra.

18. Dr. Edwin E. Graham: "A Case of Cardiospasm Followed by Hypertrophy, Dilatation and Stricture of the Esophagus, Treated by Gastrostomy and Subsequent Dilatation of the Esophageal Strictures."

The paper was discussed by Drs. Adams and Graham.

19. Dr. L. R. DeBuys: "A Case of Balantidium Coli."

The paper was discussed by Drs. Hess and DeBuys.

20. Dr. Percival J. Eaton: "A Case of 'Cribbing' in a Young Infant. Dilated Stomach: Spasm of Diaphragm."

The paper was discussed by Drs. Herrman, Cowie, Adams, Kerley and Eaton.

21. Dr. Fritz B. Talbot: "A Case of Kala Azar."

The paper was discussed by Drs. Hess, Herrman and Talbot.

22. Dr. Frank X. Walls: "A Case of Intussusception."

The paper was discussed by Drs. Morse, Porter, Sherman, Hand and Walls.

23. Dr. John Lovett Morse: "Neuroblastoma Sympathicum."

The paper was discussed by Drs. Smith, Eaton and Morse.

24. Dr. Irving M. Snow: "Cure of a Syphilitic Meningitis by Salvarsan — Symptoms — Convulsions and Intense Optic Neuritis, Developed After a Head Injury."

The paper was discussed by Drs. Eaton and Snow.

25. Dr. Charles Hunter Dunn: "An Extraordinary Case of Congenital Cardiac Disease."

The paper was discussed by Drs. Northrup and Dunn.

26. Dr. DeWitt H. Sherman: "Death from Tubercular Meningitis in a Breast-Fed Infant at Ten Weeks of Age."

The paper was discussed by Drs. Pisek and Sherman.

27. Dr. Richard M. Smith: "A Case with Vascular, Joint, Muscle and Skin Disturbances of Uncertain Etiology."

The paper was discussed by Drs. Koplik, Byfield and Smith.

28. Dr. Henry Dwight Chapin and Dr. Ludwig Kast: "Preliminary Report on the Use of Vegetable Milk."

The paper was discussed by Drs. Holt, Chapin and Schloss.

29. Dr. Howard Childs Carpenter: "A Child with Transposition of Viscera."

30. Dr. Wilder Tileston: "Migraine in Childhood."

The paper was discussed by Dr. Schloss.

31. Dr. Fritz B. Talbot: "The Energy Metabolism of an Infant with Amaurotic Family Idiocy."

32. Dr. Thomas S. Southworth: "Is the Present Frequency of Otitis Media and of Subsequent Mastoid Operation in Some Measure a Reproach to Pediatrics?

The paper was discussed by Drs. LaFétra, Adams, Pisek, Talbot, Abt, Heiman, Holt, Winters, Freeman, Smith, Carpenter, Chapin, Kerley, Porter, Hess, Northrup, Wilcox, Sherman and Southworth.

33. Dr. H. M. McClanahan: "The Relative Morbidity of Breast and Bottle Fed Infants."

The paper was discussed by Dr. Herrman.

34. Dr. Alfred Hand: "The Disadvantages of Low Fat Percentages."

The paper was discussed by Drs. Chapin, Southworth, Morse and Abt.

35. Dr. John Ruhräh: "Exhibition of Some of the Early Contributions to Pediatrics, with Notes on Pediatric Anthology."

Dr. Isaac A. Abt read Dr. Ruhräh's notes on Pediatric Anthology.

This presentation was supplemented by contributions from Drs. Herrman and Holt.

36. Dr. Henry F. Helmholz: Experimental Ascending Infections in the Kidney of the Rabbit." (Lantern Slides.)

The paper was discussed by Drs. Smith and Helmholz.

37. Dr. Frederic W. Schlutz: "Immunity Reactions in Concentrated and Dehydrated Tissues."

The paper was discussed by Drs. Abt and Schlutz.

38. Dr. Alfred F. Hess: "A Protective Therapy for Varicella."

The paper was discussed by Drs. Talbot, Herrman and Hess.

39. Dr. Oscar M. Schloss: "A Comparison of the Carbon Dioxid Tension of the Alveolar Air, the Bicarbonate of the Blood Plasma, and the Hydrogen-Ion Concentration of the Urine in Infants with Acidosis."

The paper was discussed by Dr. Marriott and Dr. Schloss.

40. Dr. Julius P. Sedgwick and Dr. M. Seham: "The Acidotic State of the Newborn." The paper was read by Dr. Seham.

The paper was discussed by Dr. Sedgwick.

41. Dr. R. Langley Porter: "Intrathecal Injections of Normal Horse Serum in the Treatment of Chorea. A Preliminary Report of Seven Treated Cases."

The paper was discussed by Drs. Schloss, Herrman, La Fétra and Porter.

42. Dr. William Palmer Lucas: "The Importance of Child Welfare Campaigns During the Present Period."

43. Dr. Paul Armand De Lille: "Medical Prophylactic Work in the Army; Its Application to the Civil Population."

44. Dr. Fritz B. Talbot: "Report of the Special Committee to Report to Council of National Defense."

The report was discussed by Drs. Hamill, La Fétra, Sedgwick, Lucas and Helmholz.

45. Dr. Richard M. Smith: "The Massachusetts Child Conservation Committee; the Details of Organization and Work."

The paper was discussed by Drs. La Fétra, Hamill, Talbot and Smith.

46. Dr. J. H. M. Knox, Jr.: "America's Opportunity in France."

47. Dr. Henry I. Bowditch and Dr. A. W. Bosworth: "Studies of Infant Feeding. XI. High Protein Feeding Versus High Calcium Absorption as the Cause of the Increase in Body Temperature of Infants."

The following papers were read by title:

1. Dr. John Ruhräh: "Congenital Atelectasis with X-Ray Findings and Exhibition of Plate."

2. Dr. J. P. Crozer Griffith: "Report of an Instance of Great Hyperpyrexia in Pneumonia Followed by Recovery."

3. Dr. J. P. Crozer Griffith: "A Pocket-Card for the Easy Calculation of Milk Mixtures."

4. Dr. H. J. Gerstenberger and Dr. H. O. Ruh: "A Combined Temperature Weight, Feed, Stool, etc., Record Chart for Pediatric Work."

EXECUTIVE SESSION, WEDNESDAY, MAY 29, 9 A. M.

The report of the Council was read by the Senior Member of the Council, Dr. Fritz B. Talbot, as follows:

The Council recommends that the following members be excused for absence from this meeting: Drs. Blackader, Fife, Friedlander, Gittings, Grulee, Knox, Ladd, Park, Machell, Shaw, Van Ingen and Veeder.

The Council recommends that Dr. Matthias Nicoll, Jr.'s, resignation from membership be accepted.

The Council presents the following nominations for officers: President, Dr. Edwin E. Graham, Philadelphia; Vice-President, Dr. Henry Heiman, New York; Secretary, Dr. Howard Childs Carpenter, Philadelphia; Treasurer, Dr. Charles Hunter Dunn, Boston; Editor and Recorder, Dr. Oscar M. Schloss, New York; Member of Council, Dr. Isaac A. Abt, Chicago; Member of Committee on Arrangements of the Congress of American Physicians and Surgeons, Dr. Samuel S. Adams, Washington, D. C.; Alternate, Dr. George H. Acker, Washington, D. C.

The Council has instructed the delegate to the Congress to vote that the next meeting be held at Atlantic City.

The Treasurer's report was received, examined by the Auditing Committee and found correct.

The Council recommends the annual assessment to be $15.

The Council recommends that members in government service be excused from paying this assessment.

The Transactions to be published by the American Medical Association.

The Council recommends that the Standing Committee on Child Welfare be not continued.

The following candidates are recommended for election to membership: Dr. Joseph Brennemann, Chicago; Dr. E. C. Fleischner, San Francisco; Dr. A. Graeme Mitchell, Philadelphia; Dr. Philip C. Jeans. St. Louis.

The Council recommends that the following honorary members be dropped from membership: Drs. A. Baginsky and O. Heubner of Germany.

The Council recommends that the American Pediatric Society endorse the need for a new Army Medical Museum at Washington, and invites the favorable consideration of Congress for the necessary appropriation.

The Council presents a resolution as follows:

"That the American Pediatric Society at its Thirtieth Annual Meeting desires to express its admiration for the great work which the American Red Cross is accomplishing, and to reaffirm its unswerving loyalty to it, being ready, individually and collectively, to further to the utmost under all circumstances, the principles for which the American Red Cross stands. That the American Pediatric Society, however, believing thoroughly in the essential need for animal experimentation as a basis for advancement in medical knowledge, and the relief of human suffering, deplores the recent action of the American Red Cross in withdrawing its appropriation for medical research, which action has apparently placed the American Red Cross in the position of denying the value of animal experimentation because of threatened withdrawal of financial support."

Dr. La Fétra was presented with a silver mounted gavel, in recognition of his service as editor and recorder from 1904 to 1917.

The presentation was made by the editor and recorder, Dr. Oscar M. Schloss, with the following remarks:

"For thirteen years you have recorded the meetings and edited the transactions of this Society. I believe that during this time you were present throughout each meeting. This Society and American Pediatrics owe much to you. It is the wish of this Society to make some expression of its appreciation of your long and faithful service. I have the honor of presenting to you this gavel as a slight expression of our great esteem and appreciation."

A service flag was presented to the Society by Dr. Samuel S. Adams.

A telegram was sent by the Society to Dr. Abraham Jacobi regretting his inability to attend the meeting on account of illness.

A letter from the Massachussetts State Board of Health was put before the Society for its consideration. The letter was as follows:

DR. RICHARD M. SMITH,
329 Beacon Street,
Boston, Mass.

My Dear Dr. Smith:—On May 9, 1918, the State Food Administrator of the Committee on Public Safety requested this Department to make an investigation of the effects, or alleged effects, of the use of war bread upon the public health. I replied that no scientific data on this subject was available to my knowledge, but that the Department would endeavor to see if there was any definite medical opinion with reference to the deleterious effects of the wheat substitutes now in use.

In pursuance of this policy I have, through the eighth district health officers, requested representative physicians throughout the State to report as to whether or not they have had any cases in their practice in which they felt war bread has produced any pathological conditions, or been a factor in aggravating further any chronic conditions.

Since then the Food Administrator's Office has called my attention to several articles which have appeared in the press tending to create a lack of confidence in the nutritional qualities of war bread. They feel that this may lead to a greatly lessened consumption of the wheat substitutes, which under present circumstances would be a very unfortunate development.

Public necessity will demand the continuance of the use of wheat substitutes, and if there are any groups or classes of the population adversely affected by its use it would seem to be of much importance for the medical profession and health administrators to get some scientific data on the subject. If we cannot find that the war bread produces any disturbance worth noticing, it would be well to assure the public on this point.

It occurs to me that pediatrists ought to be in a better position than any one else to observe and to pass upon the reality of these wheat substitutes creating serious digestive disturbances, since the group of population most apt to be affected would be the very young. Accordingly, I should very much appreciate it if you would give me your personal opinion on the matter, and such reliable scientific data as you and your colleagues may have collected.

Thanking you for your assistance in this matter, I am

Very truly yours,
[Signed] EUGENE R. KELLY,
Commissioner of Health."

After discussion of the letter by members of the Society, a committee consisting of Drs. Holt, Lucas and Chapin was appointed to put the opinion of the Society in the form of a resolution.

This committee reported as follows:

"The opinion of the American Pediatric Society upon the use of war bread.

At its Thirtieth Meeting held May 27, 28 and 29, 1918, the following resolutions were adopted:

1. Substitutes for wheat flour in war bread contain all the elements needed for healthy nutrition and normal growth.

2. Information as to the necessity for proper and uniform methods of preparation and baking should be widely circulated by the Food Administration.

3. On account of the increased amount of moisture which war bread holds, it is important that this bread be not used too fresh for children and invalids. Unless dried in the oven it is better not to use it when less than two days old.

4. Its extensive use in Belgium and France has shown that when the precautions above mentioned have been followed only good results have been observed after its prolonged use."

These resolutions were adopted by the Society.

A committee consisting of Drs. Holt, Talbot and Lucas was appointed to draw up resolutions asking the American Red Cross Society to appropriate a sum of money to be used for child welfare work in America. The resolution as adopted by the Society was as follows:

"Resolved, That the American Pediatric Society asks that the American Red Cross appropriate the sum of $100,000 this year to assist in the development of Child Welfare Work and to coordinate existing agencies now doing child welfare work in the United States, the sum to be expended under the direction of the Medical Advisory Board of the American Red Cross."

The following resolutions were sent by the President, Dr. L. E. La Fétra, to the American Association for the Study and Prevention of Infant Mortality:

"At the Thirtieth Annual Meeting of the American Pediatric Society there was adopted unanimously a Resolution asking the President of the Society to appoint a committe of its New York members to express to the Executive Committee of the Association for the Study and Prevention of Infant Mortality, their hearty appreciation of the work of the Association, and, moreover, their desire to extend to the Association in every way possible the support and cooperation of the American Pediatric Society.

In view of the impossibility of getting together a committee in the brief time intervening, this resolution is tendered by

LINNAEUS E. LA FÉTRA,
President, American Pediatric Society, 1917-1918.

A committee was appointed to participate in child welfare work throughout the United States. This committee is to be known as the "War Emergency Child Welfare Committee of the American Pediatric Society." The following members were appointed: Dr. Fritz B. Talbot, chairman; Dr. L. Emmett Holt, Dr. Samuel McC. Hamill, Dr. J. P. Sedgwick, Dr. John Howland.

A vote of thanks was given to Mrs. Curtis and the management of the Curtis Hotel for the courtesies extended to members of the Society.

HOWARD CHILDS CARPENTER, *Secretary.*
OSCAR M. SCHLOSS, *Recorder.*

THE NEGLECTED PERIOD OF CHILDHOOD*

L. E. LA FÉTRA, M.D.
NEW YORK

The rejection by Medical Examining Boards throughout the country of from 25 to 30 per cent. of men called as recruits for the Army has focussed attention as never before upon the physical condition of our population. There is interest and concern not only in our potential fighting men, but also in the physical condition and welfare of all workers engaged in war industries, whether these workers are men or women. Moreover, the experiences of the warring nations, that under war conditions not only does the birth rate fall and the infant mortality rate tend to rise, but even older children suffer because of inadequate food and worse hygienic conditions, have impressed upon us the danger of war, even when at a great distance from the battle field, to the nation's greatest asset — her children. Already in our own country the price of milk, eggs, butter and other essential foods has increased so much that the wage earners cannot afford to purchase them in sufficient amount, especially for their children past the age of infancy; so that the situation has become already somewhat comparable to conditions abroad. In prompt recognition of this situation the Federal Children's Bureau has designated this second year of the war as "The Children's Year," and has inaugurated a campaign for the saving this year of 100,000 children's lives. This "Children's Year" campaign lays upon us as pediatrists and as members of the American Pediatric Society a special obligation. We need to survey the whole chain of organized child welfare work to see what links are weak and to give our thought and effort toward strengthening any of the weak places.

When we consider carefully the many admirable preventive and remedial measures already instituted, we find that, so far as prophylaxis is concerned, there are only two periods of life that are at all adequately supervised by the medical profession, namely, the period of school life, from 6 to 12 or 14 years, and the period of infancy, from birth to 1½ or 2 years. However, the prenatal period is now being

* Presidental address.

taken up more extensively everywhere; this work is being recognized as an essential for reducing the mortality of the first year and especially of the first month. The period of adolescence is left rather to take care of itself; but there the need, though important, is not so vital.

The period of infancy from birth to 2 years is fairly well provided for by infant milk stations, or baby feeding clinics. Careful studies have been made of normal growth during this period and of the nutritional requirements for proper development. Study of the adaptation of food to the needs of infants is constant and intensive. Little babies are well cared for — inspected, weighed, and either fed from, or their feeding directed by, the Infants' Clinics and Milk Stations.

Regular daily medical inspection at school, those children showing defects or disease being referred to their own physicians or to public institutions, covers the school age very well. At least the organization has been thought out and is more or less efficient, according to the city or state administration. In many school districts a warm luncheon, either free or at small cost, is served at the school, so as to keep the pupils in good physical trim.

But when we come to the period of childhood from 2 to 6 years — the preschool age — very little has been done. After having had the greatest amount of attention from birth until 1½ or 2 years, the runabout child must largely shift for himself, so far as medical attention is concerned, until he is old enough to go to school. From the time the baby graduates from the infant milk station or from the visiting nurse of the feeding clinic to the time of entering school, no medical agency cares for him. If ill, he is treated for the acute condition, but he is not examined afterwards at regular intervals as he was when a baby. He is left to the day nursery or the older sister, as the mother is too busy to follow the little runabout all over the streets. For four years he may get into all sorts of troubles — digestive, nutritional, dentitional, glandular, or infectious — without any hindrance from the health authorities; when he first goes to school the medical inspector then will examine him and tell of all the terrible things he has acquired since he left the infant welfare station in splendid condition. The question is often asked "What becomes of all the beautiful, plump babies?" We look among the children of runabout age and find only a small proportion who look or are as well and strong as when they were babies. What has happened? These children have been neglected by organized medical agencies. Their

general hygiene and feeding have been left to the mother or grandmother, the physician being consulted only when there is acute illness. He usually advises only with reference to the urgent condition that has newly developed, and seldom follows the patient to a complete restoration of vigor and to the establishment of normal growth and development. At the clinics the children are brought only for illness, and only until the acute condition is relieved. It is to this gap in childhood supervision that I wish to direct attention.

What are the conditions during this period as regards growth and susceptibility to disease? The impulse to growth during this period is only a little less strong than during the first and second years, the average gain in weight being about 5 pounds per year, and the gain in height about 3 inches per year.

This means that from 2 to 6 years the body weight should be increased by 20 pounds, or nearly doubled, and the height should be increased by 12 inches, or over 30 per cent. Meantime great and important changes are taking place in two organs that may make or mar all the rest of the child's life. After having grown enormously during the first two years, the brain and nervous system continue to increase, though less rapidly, in size and complexity. This is well evidenced by the change in the size of the skull which, by the age of 6 years, has attained practically adult size. Many a boy of 7 can wear his father's hat. How important for the whole of the child's life that his food at this time should contain just the right sort of building material for the highly organized protoplasm of these growing nerve cells! How important that during this period of their active growth and multiplication these neurons should not be fatigued by excitement or too much work, or damaged by the toxins or bacteria of infectious disease!

The heart is the other important organ that shows great changes. According to W. Müller, the heart increases in size from a volume of 23 c.c. in the newborn to 100 c.c. at the seventh year, and increases only another 40 c.c. by the fifteenth year. The increase in weight of the heart corresponds to the increase in volume, but the circumference increases very little during this period; and Hochsinger concludes that whatever increase in circumference does occur is due, not to enlargement of the cavities of the heart, but to increase in the thickness of muscle mass in its walls.

These facts emphasize, as with the growing brain, the extreme importance of proper nutrition, freedom from overstrain, and especially protection from the damaging effects on the heart muscle cells of contagious disease, particularly rheumatic fever, diphtheria, scarlet fever, bronchopneumonia and influenza.

Susceptibility to Disease.—Young children are especially liable to contract all sorts of contagious and infectious disorders, their resistance being much less than that of elder children and adults. For some diseases their resistance is even less than that of young babies. The infant is protected by certain immune bodies, some inherited and some derived from the mother's milk. This immunity is especially valuable for infants in relation to scarlet fever, measles and diphtheria. After the middle of the first year this immunity is gradually lost, so that young children are actually far more susceptible to many contagious diseases than are the new-born. Moreover, during infancy the baby is usually guarded sedulously from exposure to those who are known to be sick, and so he has fewer chances for infection. When the baby is left in his crib he stays where he is put and is kept in cleanliness and quiet. But from the time the baby learns to creep or walk he is crawling all around the floor when indoors, and when outdoors he gets into all sorts of street dirt. Moreover, he visits and is carried about by admiring relatives and friends, or even strangers; he is kissed against his will, taken into crowded street cars and so comes in contact with a great number of people who may be sources of contagion. At home he plays with his older brothers and sisters who may bring measles or other contagion back from school. The runabout child is soon out of hand, so far as the overworked mother of the poorer classes is concerned, and he wanders into all sorts of hazards to life and limb, as well as dangers of disease. Any automobilist can bear witness to the reckless manner in which young children run or meander across crowded thoroughfares in the thickly populated districts.

The diseases and disorders found in children during this age are many of them brought over from the period of infancy; but the more important ones are either acquired or become more marked after infancy.

General malnutrition may have resulted from difficulty of adjustment of the food during the early months, or it may be due during this period to carbohydrate indigestion or to an excessive amount of

cow's milk — in either case to an unbalanced ration. Most commonly, however, malnutrition during this period is due to wrong or insufficient food and faults in hygiene. In the management of such patients the whole environment, including clothing, housing, outdoor exercises, and especially the articles in the diet must be revised so as to conform to hygienic principles and nutritional needs. Since any period of rapid growth is also one of stress and strain for the organism, all the greater care is necessary to prevent malnutrition if the normal growth processes are not to be thwarted. This is especially important at this period when the brain, the heart and other muscles are being developed to stand the work of school life.

Hereditary Syphilis.—This may show itself first during the pre-school age, generally by bone or joint manifestations, and especially by pains and other symptoms that might suggest tuberculosis. Roberts has recently pointed out the peculiar humpy 6-year molar teeth that are an early sign of late hereditary syphilis. Iritis or keratitis may be an early manifestation of hereditary syphilis at this age. Early recognition of bone and joint syphilis may save years of brace-wearing under the mistaken diagnosis of tuberculosis; for mixed treatment is most satisfactory. Moreover, a correct diagnosis may prevent serious impairment of the hearing or even brain involvement. Children with positive Wassermann test should be under constant supervision.

Tuberculosis.—This may be present in various forms — chiefly at this age in the bones or lymph nodes, less frequently as pulmonary involvement with formation of cavities, or as meningeal tuberculosis. In the medical wards at Bellevue we have constantly examples of pulmonary tuberculosis, often with cavity formation, and of tuberculous meningitis in children of the preschool age. Prophylaxis consists in separating young children from an infectious environment. Probably the best method is to have the healthy children sent to live for a year or more with healthy families. Failing this prophylactic treatment, the best methods are those of rest in the open air, heliotherapy and high calory feedings.

Rickets. — This is preeminently a disease of the pre-school age. Faulty internal glandular secretions, often congenital, as well as bad hygiene and foods too high in carbohydrates as compared to the fats and protein are the causes of the disease. It must be emphasized that rickets is a disease that affects not only the bones, but the muscles, the lymphoid tissues, the nervous system, the blood and the mucous

membranes. It predisposes especially to bronchitis and bronchopneumonia and renders more severe any intercurrent infectious disease. Rachitic children are especially apt to have convulsions from slight causes, and to suffer from gastro-intestinal disorders. The bad effects of the softened bones must be prevented by rest, massage and appropriate exercises and apparatus. In this connection should be mentioned weak foot, round shoulders and other faulty postures. These all begin early in life, before the school period, and their correction would be much easier and more satisfactory if undertaken early. Properly adapted shoes or plates, together with exercises, will prevent most of the flatfoot of later life. In connection with the prevention and treatment of faulty posture, the American Posture League has devised proper chairs for young children, as well as waists and hose supporters that all encourage correct posture. The effect of correct posture on the development of the chest, and therefore on that of the heart and lungs, needs no emphasis.

Backwardness of various sorts — including cretinism and mongolism — can be recognized early in this period and should have each their appropriate treatment long before the school age is reached. Nervous children, those without proper self control and those with bad habits, either sexual or tics, need special attention during this period lest the habits become too firmly fixed by the time the school age is reached.

Adenoid growths, malformed jaws, and congenitally high arched palate all interfere seriously with proper nasal respiration, and therefore prevent adequate oxygenation of the blood, with all this implies, and they also prevent adequate sleep. Inflamed adenoids predispose to otitis and mastoiditis, and chronically enlarged tonsils predispose to cervical adenitis and to acute general microbic infections, especially arthritis, chorea and endocarditis. Carious teeth, aside from interfering with proper mastication and being a source of local mouth inflammation may, like chronically inflamed tonsils, be a focus of general infection to the whole organism, either of an acute or more rarely of a tuberculous nature. Obviously, all these conditions call for early treatment in so far as relief can be promised. Adenoids and tonsils can be removed, carious teeth can be cleaned and filled, and malformed jaws can be widened and often the high palate lowered so as to increase the breathing space in the nostrils. The removal of adenoids and tonsils is the more important because their presence

encourages serious complications, if the patient later should contract scarlet fever, measles, diphtheria, influenza or pneumonia.

Acute Contagious Diseases.—Scarlet fever is made more dangerous by the presence of enlarged tonsils and adenoid growths, since these predispose to serious ear disease and to inflammation of the cervical lymph nodes with increased toxemia. Early recognition and careful treatment are necessary to modify the disease in its acute course and to prevent cardiac complications and chronic disease of the kidneys.

Measles is a danger to children of this age because of its complications — bronchopneumonia and otitis. The ear complications of measles are frequently just as serious as those following scarlet fever, so that constant vigilance is required to forestall mastoid involvement. Moreover, the mastoid inflammations in measles are of grave nature, leading to rapid destruction of the bone, so that prompt operation is necessary. Measles predisposes the patient to tuberculosis, so that greater care should be taken during convalescence of measles patients, if the family history is tuberculous.

But of all the acute contagious diseases, the most distressing is whooping cough. It is, moreover, most prevalent during the pre-school age, more than 75 per cent. of the cases reported being in children under 5 years. As to its fatality, about nineteen out of twenty of the deaths from whooping cough occur in children under 5 years old, more than half of the mortality being in the first year of life. The disease, lasting so long, is most debilitating, since it is so often complicated by gastro-intestinal disturbances, by bronchopneumonia, and predisposes to asthmatic bronchitis and to tuberculosis.

Acquired cardiac disease frequently has its inception during the preschool age, usually following severe tonsillitis or one of the acute infections. Its early recognition and differentiation from congenital defect should lead to appropriate treatment by rest and nutritious diet, later by regulated exercise and by removal of diseased tonsils and carious teeth. At the Huddleston Cardiac Clinic, conducted by Dr. Smith at Bellevue Hospital, a large number of the patients successfully treated are below the age of 6 years. There have been numbered in this class eighteen cases of cardiac disease under the age of 6 years, all of them being instances of mitral regurgitation, one with the addition of stenosis and another with the addition of aortic

regurgitation. Among these eighteen there were six under the age of 5 years. This means a great deal to them for their later ability to attend school.

Of the acute contagious and infectious diseases there will be mentioned only those that affect with especial severity the children of preschool age. Bronchopneumonia is the most serious disease at this age, particularly because it is the usual complication of measles and whooping cough, and adds very greatly to the mortality of these diseases. Even if not bringing about a fatal result, bronchopneumonia leaves the little patient badly debilitated and at times suffering from chronic interstitial changes in the lung.

After bronchopneumonia as a cause of death during this period come in order diphtheria, measles, scarlet fever and whooping cough. But measles and whooping cough are so frequently complicated by bronchopneumonia, that the death rate, especially in institutions, is really much higher than the formal returns of these diseases would indicate, the chief cause of death being stated as bronchopneumonia.

If it were only possible to protect young children from these infections until after the age of 5 years — that is, until the susceptibility to bronchopneumonia is less, and the organism had gained better general resistance — there would be a great saving of life, as well as a reduction of prolonged illness.

Systematic vaccination against whooping cough has seemed in some instances to be of great value; my own experience is in favor of the employment of this vaccine; but so many observers are sceptical of its value that further studies of the question are necessary. Whether or not it will be possible to confer immunity to measles and scarlet fever by injections of serum or by vaccination, time alone will tell. Certainly it would be a great boon to be able to pick out the susceptible children, as one can in the case of diphtheria by the Schick test, and then to give them some treatment similar to the toxin-antitoxin for diphtheria proposed by Park and Zingher.

Defects.—Few systematic studies have been made of the defects found in children of the preschool age, but the medical school inspections of the lowest school grades give an idea of the conditions. Sobel of the New York Bureau of Child Hygiene has published the results of examination of over 2,000 children of the preschool age, the examinations being conducted at some of the baby health stations during the years 1914 to 1917.

From 8 to 16 per cent. examined were found to have defects of teeth only, and from 58 to 66 per cent. had general defects. The defects found were tabulated as follows:

	Per Cent.
Defective vision	4
Defective hearing	2
Defective nasal breathing	25
Hypertrophied tonsils	25
Defective nutrition	27
Cardiac disease	2
Pulmonary disease	3
Orthopedic defects	7
Nervous disorders	1

At the Bowling Green Neighborhood House, a settlement in the Syrian district of lower New York, Dr. Hill has for the past four years been making regular monthly examinations, with follow-up visits by nurses at the home, of children of the preschool age. Upward of 800 children have been followed and their feeding and hygiene directed, with most gratifying results. At Bellevue Hospital Dr. Smith is now organizing a clinic for the regular examination of such children to improve their nutrition and correct any remedial defects.

The first measure necessary toward bridging this gap in our medical supervision is to make a survey of the actual situation. This has already been proposed for New York, where there are estimated to be about 600,000 children under 6 years of age. A house-to-house canvass is to be made and the children are to be examined with special reference to the presence of malnutrition, enlarged tonsils and adenoids, carious teeth, cardiac disease, rickets and tuberculosis. Also with regard to children who were made cripples by the poliomyelitis epidemic of 1916. Appropriate treatment will be advised, and the effort will be made to educate the lay public, which is just now in a very receptive frame of mind, as to the necessity of periodical examinations and care of their children before they enter school. Incidentally the importance of protecting infants and young children from all sorts of contagious diseases, including the common infectious cold will be emphasized. In addition to the instruction by nurses or social workers at home, there should be established by the various outpatient departments of hospitals and by the Department of health, consultations for preschool age children where the mothers can be taught about proper nutritious food, about clothing, cleanliness of body, hands and teeth, and about the necessity for fresh air and suffi-

cient hours of sleep. In connection with the survey and examination of these children there would be the opportunity to collect data, on the height and weight of normal children from 2 to 6 years of age. Standards based on a sufficient number of careful observations are lacking. What is greatly needed is to follow a large number of the same children of different nationalities through a period of later years and then note the individual growth rate. In this way we could get a better idea of the normal rate for the different races of our population.

Studies of nutritional requirements of these children, when quiet and when in active play, should also be made.

Hygienic Supervision.—There should be better provision in the home for ventilation of the sleeping rooms and of the room in which the children play. Too often it is the warm and steamy kitchen. The fire-escape and the basket set out of the window are no longer adequate for airings at this age. Roof playgrounds on the tenements, as proposed by Dr. Northrup, would be an admirable solution of this need; for in a few minutes the mother could take her child early each morning to the roof playground where he could meet other children for play and exercise, and all could be cared for by one of the children's mothers, each taking her turn for part of the day.

There is great need of supervised playgrounds for small children, of day nurseries for runabouts and of kindergarten or Montessori training for the somewhat older children. Supervised play or work means happy exercise in cleanly and healthful surroundings; and since filth infections play a large part in causation of affections of the mouth, nasopharynx and skin in young children, a clean environment is most important. Kindergarten and play schools, indoors and out, should be multiplied so that those mothers who cannot themselves give or procure proper attention for their young children can send them where they can be cared for. In other words, the school age should be lowered; the little scholars could be gathered in and distributed back to their homes by motor bus, just as the crippled children are now taken to and from their schools.

Technic of the Streets.—In connection with playgrounds, a most important consideration in crowded districts is the question of street hazards. The majority of injuries to persons by horse-drawn and motor vehicles occur to children under the age of 6 years. This is partly because these little ones have nowhere else to play than in the streets, and partly because they are taught by their mothers, when sent on an errand, to run as fast as they can when crossing a street.

This injunction by the mother is probably the cause of a vast number of accidents, for when a child darts out from the sidewalk, and with eyes fixed on the distant side of the street, runs as fast as he can, it may be impossible for an approaching vehicle to avoid him.

To cope with the matters of these street accidents, something more is necessary than to regulate the speed of vehicles. In the first place, when playgrounds are furnished, the children should be compelled to play in the space provided and not in the adjacent streets; secondly, certain street blocks should be set aside as play streets, and between certain hours no through vehicular traffic should be allowed. All the children from several adjacent blocks could play in the restricted street, and they should not be permitted to play on streets where through traffic is allowed. Finally, the technic of the street should be taught to children from the time they begin to walk out doors. They should be cautioned always to *walk,* not run, across the street, and to look each way, particularly to the left, as they step from the sidewalk. They should be taught never to cross in the middle of a block, that is, always at the crossing. They should be made to play only in places, either street blocks or playgrounds, set aside for that purpose, and they should be especially warned against "hooking on" when roller skating, and against jumping on and off the back of moving vehicles.

These lessons should be taught and emphasized by placards and by moving pictures such as the New York traffic squad has exhibited. These films show the hazards of the streets and the common ways by which accidents are encouraged; these films are especially good in their lessons to children. This sort of instruction is life saving and should be carried on by all child welfare agencies including public schools, day nurseries, clinics, Sunday schools and moving picture houses.

It is altogether probable that the best method of carrying on the work of supervision after the original survey of these children has been made, would be to have the preschool children of each district examined at regular intervals, preferably twice a year at the nearest school in some room set apart for the purpose. Any children found below par, either as regards nutrition or suffering from specific defects, could be referred to the hospitals or clinics for needed treatment. Whatever plan is adopted, it is certain that by recognizing that the preschool age is in need of definite medical supervision, not only will a large number of lives be saved, but a vast amount of illness will be prevented, and children will enter school with a higher standard of health and of physical and mental capacity.

HEMOPTYSIS FOLLOWING EXPLORATORY PUNCTURE OF THE CHEST

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Some time ago an infant 6 weeks old was admitted to the hospital with an outside diagnosis of lobar pneumonia. The history chart states that the child weighed 6 pounds at birth and 6 pounds at the time of its admission into the hospital, the symptoms of respiratory embarrassment dating back two weeks. When admitted the infant was moribund and markedly cyanotic. It had a rapid, jerky, shallow respiration, a rapid, hardly perceptible pulse. Percussion revealed flatness over both lungs posteriorly, pectoral fremitus was absent below the scapula on both sides. To make sure as to the presence or absence of serum or pus, an aspirating needle of moderate caliber was pushed through the seventh interspace into the dull area of the right thorax for about ¾ inch. This procedure was followed by a feeble coughing effort and by a brisk hemorrhage from the mouth, and in less than a minute life was extinct.

At the necropsy the foramen ovale was found patent, presenting a slit-like opening 2 mm. in diameter. Beneath the leaflet of the mitral valve there was an opening in the interventricular septum about 8 mm. in diameter.

The cardiac musculature was of about the same thickness on the right as on the left side. There was a distinct inflammatory consolidation in both lungs and marked congestion of the entire lung.

There was an extensive hemorrhage into the right pleural cavity, and there may have been fluid in this cavity, but it was obscured by the hemorrhage. The tract of the needle in the lower quadrant of the middle lobe could be followed for ¼ inch and a puncture of a larger blood vessel could not be made out. There was no laceration of the lung tissue as the specimen herewith presented shows.

Another fatal sequence to an exploratory puncture came under my observation about fifteen years ago. A feeble, poorly nourished cyanotic child 2 years old was admitted to the hospital service of a colleague after a two weeks' illness with a high temperature, signs

and symptoms of a right-sided pulmonic consolidation and urgent respiratory embarrassment. Vocal fremitus was not in evidence and respiratory sounds were indistinct. To make sure as to the presence or absence of serum or pus a needle was introduced. Fluid was not aspirated, and on withdrawing the needle a brisk hemorrhage from the mouth took place and the child was dead in a few minutes. An autopsy was not granted.

COMMENT

Fatalities from exploratory puncture of the thorax are exceedingly rare. In the annals of our society, now extending over a period of thirty years, no such occurrences have been reported. A colleague who is now in France told me before his departure that a number of cases had been culled from medical literature and reported, but I have been unable up to the present time, to secure this report, and I imagine that for obvious reasons some of the fatalities following exploratory puncture are not published.

In my own clinical experience of forty years, during which many thousands of exploratory punctures have been performed, the two cases here reported stand out prominently. I can recall, however, several instances in which a puncture in adults was followed by streaks of blood in the sputum, with a prompt return to the normal after a day or so. To plunge a needle *lege artis* into the lower thorax is considered a harmless procedure by the diagnostician. The indications for exploratory puncture are definite, and in the light of clinical experience are frequently imperative as a life-saving inquiry. On the other hand, the precise condition under which a simple puncture may be hazardous should be carefully considered.

The capillaries of the lung vary greatly in capacity, and they can take up a very large quantity of blood when cardiac insufficiency or pulmonary inflammation induce pulmonary congestion.

Recent experiments by Kuno of the Japanese Medical School at Mukden have shown that the amount of blood which the lungs can hold varies from 9 to 19 per cent. of the total amount of the blood of the body.

Thus, if a highly engorged lung is punctured, a localized hematoma may result, and if in addition the clotting time of the blood is altered and prolonged, as in hemophilia and in cachectic individuals with an acquired lytic or hemorrhagic diathesis, a free hemorrhage into the pleural cavity and trachea may take place.

In the first case cited a chronic congestive condition of the respiratory tract existed from birth, due to the pronounced congenital heart defect.

In the second case an extreme congestion of the lung was brought about by the pneumonic infection and inflammation, accentuated by cardiac insufficiency as a result of two weeks' strain on the heart of a feeble individual. In neither case was the hemorrhage due to faulty technic. The practical lesson to be drawn for the guidance of a clinician is to bear in mind that in acute cases, in which a puncture seems indicated, the introduction of an exploratory needle into the thorax containing a highly congested lung is attended with some degree of risk when a cyanosis and other characteristic signs point to cardiac or circulatory failure. In obscure subacute and chronic conditions a roentgen-ray examination should precede and may obviate the necessity of a puncture. When exploratory puncture of the chest is performed for the purpose of eliciting the character of an exudate or transudate which otherwise reveals its presence by characteristic physical signs, including a bulging of an intercostal space during inspiration, the danger of an internal hemorrhage is practically *nil*. Extreme collapse and sudden death without visible hemorrhage following exploratory puncture of the chest has also been observed, and must be attributed to shock when a necropsy reveals absolutely nothing to account for the fatal outcome.

BREATH HOLDING IN INFANTS

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Breath holding (also known as hysterical laryngospasm, rage spasm, and inspiratory apnea) is a condition not infrequently observed in early childhood. At first glance one would be led to believe that the attacks are manifestations of spasmophilia or tetany with the associated laryngismus stridulus, but on closer investigation it will be discovered that such assumptions are erroneous. The breath holding attacks, as distinguished from laryngismus stridulus, manifest no true laryngeal spasm. The breathing stops suddenly in the midst of a crying attack, but there is no inspiratory spasm.

The attack may be briefly described as follows: The child works himself into a rage, cries for a time, and then suddenly stops, finding it impossible, for a brief period, to make any further sound. The inspiratory muscles remain in a tonic state. The child throws himself about and becomes cyanotic or pale. Then the body becomes rigid and the eyes turn or become set. For a moment it seems that the child is asphyxiated. The attack usually lasts a few seconds and then disappears. It may, however, continue for several minutes, while in the more severe cases it may be followed by convulsions.

Barthez and Rilliet are among the first to speak of breath holding. They describe it as a condition occurring in passionate (angered) children, manifested by a suspension of the respiration accompanied by suffocating inspiration, during which the face becomes purplish and the extremeties cold. Sometimes it is followed by an eclamptic attack. They say it is not possible to distinguish breath holding from glottis spasm.

Ibrahim reports three cases, the first two of which are dismissed with only a short reference. In the first there had been laryngismus stridulus of the ordinary type in early infancy. In both, the rage spasms were characterized by emotional excitation, cyanosis, unconsciousness, and great drowsiness. The third case is described in great detail, the principal points of which were the following: The mother was an extremely nervous woman and is said herself to have suffered from rage spasm during infancy. The infant thus had a nervous

stigma, although there was neither epilepsy, insanity, nor other nervous disease in the family history. Ibrahim had this baby under observation since earliest infancy. During the second year, the child in the midst of a crying attack would hold its breath and become cyanotic; the body would grow limp. Respiration would apparently cease. At the end of the attack, the child would cry lustily for a few moments and soon afterward fall asleep.

Ibrahim calls attention to the fact that all the classical signs of tetany, including the electrical reactions, were searched for but were not found.

H. Neumann[1] in his discussion of breath holding, tries to differentiate it from tetany. Laryngismus stridulus, he says, is a manifestation of spasmophilic diathesis or tetany and tends to disappear during the first year or two of life; whereas the inspiratory apnea or breath holding attack is an early symptom of neurasthenia. He also says that in numerous cases which he has examined, the classical signs of tetany were usually absent. There was one exception, however, a boy of 4 years, who, suffering evidently from rage spasm, showed very definitely Chvostek's facial phenomenon. His father, who was an extremely neuropathic individual, showed the same sign.

A further differentiation may be made in addition to Neumann's observations. Attacks of breath holding occur commonly in the second and third years of life and tend to disappear about the fifth; whereas genuine spasmophilia makes its appearance during the first year or two.

It will occur to everyone that the resemblance between these breath holding attacks and minor epilepsy is such that the differentiation of the two may at times present great difficulties. It should be remembered, however, that breath holding attacks follow immediately after severe crying, excitement, or anger; while epileptic attacks occur suddenly in the midst of quiet play or even during sleep. Biting of the tongue, which is characteristic of epilepsy, does not occur in breath holding. On the other hand, involuntary evacuation of the bladder or rectum may occur in either attack. Another point of resemblance is the prolonged sleep usually following an attack which is characteristic of both conditions.

Neumann reports a case in which breath holding attacks or rage spasm occurred in an epileptic child 3 years old. He had suffered

1. Arch. f. Kinderh., **42.**

from epilepsy since his third month of life and presented at times unmistakable convulsive seizures. On certain occasions, however, when he lost his temper or became frightened, he would hold his breath, become cyanotic, and after a brief period would lapse into a deep sleep.

It would seem that an important point in the differentiation of the two conditions is to be noted in each case in the progress of the disease, namely, that breath holding attacks tend to recover completely, while epilepsy, as a rule, persists.

I have seen on several occasions attacks of whooping cough in young infants and children that required differentiation from breath holding seizures. A few days ago, for instance, a child was brought into my office because of peculiar respiratory attacks that alternated with coughing. At night the child not infrequently had severe coughing attacks which the parents thought resembled whooping cough. During the day, however, the coughing was substituted by paroxysms of breath holding; undoubtedly they were voluntary attempts to suppress the cough. They were characterized by extreme cyanosis, great prostration, relaxation of muscles and momentary unconsciousness. The baby gives one or two short coughs, then she becomes blue and rigid. She has a facial spasm, the eyes become set and roll upward, arms and legs are rigid and the mouth is tightly closed. The attack lasts several minutes. Cyanosis disappears, normal breathing is resumed and consciousness returns. This seventeen months old baby had such an attack in my office. These alternating attacks of coughing and breath holding had been going on for four or five weeks, during which time one or more typical whooping cough paroxysms occurred almost nightly.

I also recall the history of a baby 2 weeks old who acquired whooping cough from the mother. The child began to cough when it was only 10 days old. Each paroxysm was characterized by a slight crowing. He would become intensely cyanotic and fall limp in the mother's arms with complete respiratory cessation. At such times, the pulse was slow and the child seemed lifeless. After a few moments the patient regained color, and breathing proceeded normally. The baby ultimately recovered.

Cases of breath holding are not of uncommon occurrence. Very often they are the cause for emergency calls for the medical attendant, though as a rule, he discovers when he arrives on the scene that the

child has recovered. Only the other day a mother came to my dispensary clinic with a large, well developed baby of 22 months, who presented all the characteristics of breath holding or rage spasm. The mother described in minutest detail all of the points which have already been referred to. If the child was crossed or thwarted in any way, it would cry, hold its breath, become cyanosed and momentarily unconscious. The child was very well nourished, presented no evidence of rickets, no carpopedal spasm, and no Chvostek or Trousseau signs.

Another case further illustrates the disorder. A mother brought her 17 months old baby to us on May 5, 1918, because of anemia and great fretfulness. The child had always been delicate and sickly, was very difficult to feed, and suffered from severe malnutrition. She was extremely irritable and cried much of the time. About two weeks before we saw her the child began to fret more than usual, would become extremely irritable and work herself into a rage, which would be followed by a breath holding spasm. The mother said that five or six of these attacks occurred daily. None of the typical signs of tetany was present, though there was a slight increase of electrical excitability. We improved the child's feeding and suggested a plan of psychotherapeutic treatment which the mother, who was a very intelligent woman, immediately adopted. She refused to pick up the child when she cried, treated her sternly, shook her finger at her, and reproved her when a breath holding attack was imminent or in progress. The treatment finally proved successful. Although on the first day after the baby's admission to the hospital we were enabled to witness several typical attacks which consisted of fits of temper, crying, breath holding, cyanosis and momentary unconsciousness, on the second day they had completely ceased.

These attacks of breath holding occur in neuropathic children and are brought on by fear, anger, fright, or some other psychic trauma. As a rule, children subject to such seizures are irritable and ill-tempered. The condition is very often aggravated by neuropathic parents who, fearing the recurrences of these attacks, humor them in every possible way, permitting no one to cross the child and allowing no whim or caprice to remain ungratified. It is obvious, of course, that such treatment does not help the child to build up any degree of resistance to the recurring attacks.

After some time has elapsed, most of these patients practically recover, although in some instances, as has been pointed out, the

attacks may be severe and protracted. Children who fall ill with an acute infectious disease, or who, by reason of accident or injury, require surgical treatment, may be seized with a severe breath holding attack, accompanied by general convulsions, as a result of the fright which they have sustained. Under such circumstances the attack may be so severe as to terminate fatally.

Treatment should be directed toward the general management of the nervous child. Mental stimulation of every kind should be avoided. He should be ignored as much as possible by parents and friends. When the attacks occur, there should be no fussiness or consternation, or any of the hysterical manifestations usually evinced by mother or nurse. Cold water dashed into the face has been suggested as a direct remedy. Finally, the patient should be shown in no uncertain manner that any repetition of the attack will meet with harsh if not painful measures.

Frequently the patients improve most rapidly when they are removed from the excitement and tension of home surroundings. A short stay at the hospital away from parents and friends is often advisable. At times a short course of bromids may be required in addition to psychotherapy.

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DISCUSSION

DR. FREEMAN: A case of this sort in my practice presented some interesting features. The child had severe attacks, particularly when left by a nurse to whom he was devoted. These attacks were sometimes prolonged until the child became unconscious. When about two years old he had a slight cold for several days, followed by a sudden rise of temperature, with severe dyspnea, which resulted in death at the end of twelve hours. This led to the suspicion of a large thymus gland, but this could not be corroborated by necropsy.

DR. EATON: Some years ago I had a family of four boys under my care and three of them were subject to these rage spasms. The eldest of the boys was quite a serious case. The parents of these children were not neurasthenic. They practically followed out the treatment Dr. Abt suggests. I have found that by forcing the mouth open by pushing the cheeks in and then drawing the tongue out, some reflex is excited which relieves the spasm of the glottis. Two other children of these four had the same thing but to a lesser degree. There was nothing about the psychology of the environment of these children that would account for it. I have found in several other cases that pulling the tongue out stops the spasm.

DR. HEIMAN: We all see a good many of these cases. Some of these are simple cases of breath holding such as Dr. Abt has described, but there are other borderline cases which present a condition very much like spasmophilia with Erb's phenomenon. The proper treatment for these cases corresponds to that described by Dr. Abt.

DR. HERRMAN: By pushing the lower jaw forward in whooping cough, according to the method described by Naegeli, the spasmodic cough can be stopped, and I suppose that in breath holding, pulling the tongue forward acts in the same way.

DR. ABT: In reply to Dr. Heiman's remark that these cases might be a mild form of spasmophilia, I think we find that none of these cases of breath holding occur until about the second year, whereas spasmophilia manifests itself earlier. Of course, I suppose one might have spasmophilia without the classical symptoms. These children that I have considered in the paper were, first of all, ill tempered, had short crying spells and then developed the attacks referred to. After careful examination of the patients I concluded that they were not cases of spasmophilia.

DR. LA FÉTRA: We all meet these cases and we have assumed that we could assure the family that these children would not die as a result of their breath holding attacks. We have now heard of one instance in which a child did die as the result of such an attack. However, we are quite safe in making the statement that the attacks are almost never fatal. It seems to me that these cases are to be regarded as Dr. Abt has described them. The children are wilful, lack self control and they have a nervous inheritance. They are comparable to the children who can vomit at will. Such children if they are given a food that they do not like can take it out on the parents by vomiting, while the breath holding child shows its displeasure by turning blue. Disregard of the attack and punishment are the proper methods of treatment.

INFANTILISM, WITH TWO CASES OF THE BRISSAUD AND THE FRÖLICH TYPES, RESPECTIVELY

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The subject of infantilism has come in recent years into ever increasing prominence. The term should be applied not only to adolescents or adults who possess in some degree the bodily and often the psychic characteristics of infancy, but to children of any age in whom there is a persistence of characters, especially sexual, which belong to a period of life decidedly earlier than the actual age of the patient. Further, a sharp distinction should be drawn between infantilism and nanism. There may be dwarfs who are in no respects infantile, such as those of a rachitic or achondroplastic nature. As Hastings Gilford[1] has pointed out, there has been in them an arrest of *growth,* but not of *development.* Less often there may be cases of infantilism which are the reverse of being dwarfs, as in one of the instances which I desire to record.

Much confusion still exists, however, in the classification of forms of infantilism. That proposed by Hastings Gilford[1] is worthy of serious consideration. The cases are divided by him into the essential forms, including ateleiosis and progeria; and the symptomatic forms, including the Lorain and the Brissaud types. Other forms of symptomatic infantilism have been described; among them the intestinal, pancreatic, pituitary, renal, cardiac and lymphatic forms.

It is not the intention, however, to review the subject at length in this connection, but merely to report two instances of the Brissaud and the pituitary types, respectively. They are put on record not only on account of their intrinsic interest, but because in some respects they were studied with considerable care.

REPORT OF CASES

Case 1.—Mary G., aged 7 years, Italian, entered the children's ward of the hospital of the University of Pennsylvania, Jan. 23, 1912. The family history was negative, the parents and grandparents having been apparently normal in development. Five other children were living and well and in normal condition. The father had some asthma, but in other respects had good health. The child was well during infancy and breast-fed up to the age of 21 months.

1. Gilford, Hastings: Lancet, London, 1914, **1,** 587.

When 1½ years old she had a severe attack of whooping cough lasting six months, exhibiting spasms of coughing in which she would often fall to the floor, "looking as if she were dead." Since that time she is said not to have grown any physically, although mentally the parents think she is normal. She frequently cries and complains of pain before rain or damp weather. She also appears to be a trifle weak in her legs at times. A year prior to admission she was examined by Dr. J. W. McConnell of the Department for Nervous Diseases, who found the mental condition apparently normal.

Examination.—A well nourished Italian child. The extremities seem short for the size of the thorax, and the legs are slightly bowed. The skin is harsh and dry, with a tendency to gooseflesh. The child talks plainly and coherently, answering questions rationally, as far as can be determined, but she speaks chiefly Italian. She seems strong for her size, but walks with a slight wabbling gait. Her weight is 20 pounds (normal for the age, 49 pounds); her height 29 inches (normal for the age, 45 inches). Expressed relatively, this child at 7 years has the weight belonging to one of 10 months, and the height of one of 20 months. The head is rather large and well formed; the hair short and slightly dry and harsh. No enlargement of the cervical lymphatic glands is noted, nor any rigidity of the neck. The eyes are somewhat far apart; the palpebral fissure narrowed, but without slanting of the eyes. The tongue appears slightly larger than normal, but does not protrude. Examination of the nose, ears and pharynx gives negative results. The thyroid gland cannot be palpated, and this region in the neck does not seem to be as full as in normal children. The chest is short and full. There are slight subcutaneous fatty deposits in the supraspinous fossae. There is no enlargement of glands in the axilla. The heart and lungs appear to be normal; there is no beading of the ribs; the abdomen is much distended, resulting in a distinct costal flare, and producing a compensatory lordosis of the lumbar spine; no masses can be felt in the abdominal cavity; the spleen cannot be felt, and the liver is not enlarged. Nothing wrong is discoverable in the extremities other than the shortness and bowing referred to.

January 24 measurements were taken of different parts of the body, contrasting these with similar measurements of a boy of the same age in the hospital at the time. The measurements of the patient were taken again on June 7, and are shown in the third column in the tabulation.

MEASUREMENTS

	Normal Boy, Jan. 24, Inches	Marie, Jan. 24, Inches	Marie, June 7, Inches
Height	48	29	30¼
Dorsal spine to iliac crest	11½	8	8½
Dorsal spine to floor	38	21½	22½
Anterior superior spinous process to external condyle	13¼	7¼	7¾
Anterior superior spinous process to external malleolus	24	13¼	14
Arms	15½	8	8½
Hands	5½	3½	3¾
Fingers	2½	1¾	1¾
Suprasternal notch to symphysis	15½	11	11½
Suprasternal notch to floor while standing	39	21	23¾
Suprasternal notch to glabella	18¾	15¼	17½

The contrast in size is well shown in the accompanying photograph (Fig. 1).

The patient while in the hospital was cheerful, active, and seemed to be of good mentality, as far as could be judged in a child of foreign parentage with a limited knowledge of English. The temperature averaged somewhat below normal—from 97.5 to 98 F. She was troubled at times with cough, which yielded to treatment, and early in June it was noticed that she was perspiring a good deal about her head. Apparently she did not have this condition earlier,

Fig. 1.—Infantilism of Brissaud type; patient beside a normally developed boy of the same age.

and it may have been the result of treatment. The bowels were regular, formed or soft, brownish in color. Bacteriologic examination made on June 9 showed the stools negative for *Bacillus bifidus, Bacillus infantilis,* coccal and fermentative forms. Roentgen-ray examination of the body made by Dr. Henry K. Pancoast revealed nothing abnormal. The blood examined on admission gave hemoglobin, 58 per cent.; red blood corpuscles, 3,440,000; leukocytes, 11,000; with polymorphonuclears, 69 per cent., and lymphocytes, 21 per cent. The last examination, on June 9, showed hemoglobin, 70 per cent.; red

blood corpuscles, 4,000,000; leukocytes, 8,000, with polymorphonuclears, 36 per cent., and lymphocytes, 45 per cent. Examination of the urine made on several occasions showed a faint trace of albumin, and at times a few cylindroids and casts, but no indication of any disease of the kidneys.

Thyroid extract was first administered in doses of one-half grain three times a day, and continued until March 31, when it was increased to 1 grain three times a day. This was persisted with until May 3. Meanwhile there had been at first a moderate loss in weight, followed by a slight gain; so that on May 3 she had lost in all about a pound. There had been, meantime, a slight but noticeable increase in the size, as is shown in the measurements taken on June 7. On May 3 the thyroid extract was discontinued and pituitary extract given until May 27 in doses of 1 grain three times a day. She left the hospital June 16 weighing 21 pounds.

This case was at first supposed to be intestinal infantilism, and the provisional diagnosis to this effect was recorded on the case-history. Further study seemed, however, to negative this diagnosis. There was not the general poor health, emaciation, anemia and disturbance of the gross character of the stools seen in this disease; and bacteriologic examination of the feces showed, as stated, an absence of the *Bacillus bifidus, Bacillus infantilis* and coccal forms, which, according to Herter, are present in intestinal infantilism. On the other hand, certain features existed which were very suggestive of infantilism of the Brissaud type. There were, namely, the moderate harshness of the skin, the bowing of the legs, the prominent abdomen, the moderate deposits of fat over the scapulae, and the like, all of which pointed to a hypothyroidism; not, it is true, of a degree to produce cretinism, but at least to make the subject cretinoid. The roentgen examination reported negative findings. Certainly there was nothing of a nature about them to suggest achondroplasia, nor were there, indeed, any other symptoms characteristic of this affection.

CASE 2.—John S., aged 11 years; admitted to the Children's Ward of the Hospital of the University of Pennsylvania, Feb. 7, 1915, for excessive obesity. The parents stated that the tendency to the undue deposit of fat had been noticed since the age of 11 months. This had been gradually progressing and did not seem to be influenced by diet. The health in other respects had been good, and his mental capacity rather above the average, they thought. He had always indulged in a fair amount of exercise. The father said that the boy had had a fall when 14 months old, to which he attributed the existence of a limp. Both parents are stout, but not to any abnormal degree; one brother and one sister said to be "plump," but not excessively fat.

Examination.—The boy is unusually large for his age (Figs. 2 and 3), and excessively obese. The breasts are large, apparently from deposit of fat; the thyroid gland cannot be felt; there is nothing abnormal about the heart, lungs,

or abdomen. He appears to have the full intelligence of a boy of his age. The following measurements were taken: height, 5 feet 1 inch (normal for age, 4 feet 5 inches); weight, 251 pounds (normal for age, 70 pounds); circumference at nipples. 45½ inches; just below this, 44 inches; at umbilicus, 47 inches; at anterior superior spinous processes, 51 inches; of left thigh, 34 inches; right thigh, 33 inches; calves, 21 inches; ankles, 11 inches; arms, 15½ inches; left forearm, 12 inches; right forearm, 12½ inches; left wrist, 8 inches; right wrist, 7½ inches. In brief, this boy at 11 years has the height of one of between 14 and 15 years, and a weight beyond that of a normal man.

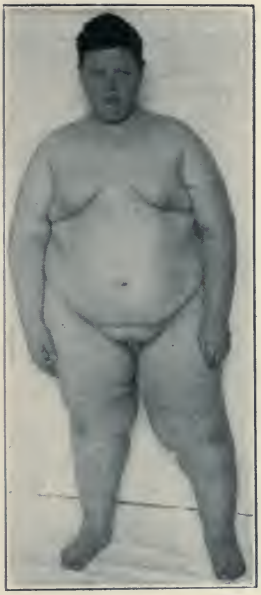

Fig. 3.—Pituitary infantilism.

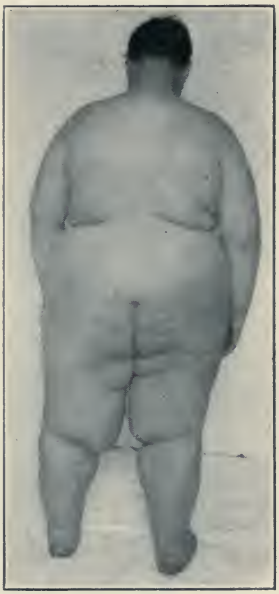

Fig. 2.—Pituitary infantilism.

The boy walks with a distinct limp. The abdomen is very pendulous. The penis is buried in fat, but seems to be small for his age and very small for the rest of his development. The testicles are descended, but are very small. There is almost no trace of pubic hair.

The blood contained 4,740,000 red blood cells; 8,600 leukocytes; 80 per cent. hemoglobin; polymorphonuclears, 76 per cent.; lymphocytes, 19 per cent.; large mononuclears, 4 per cent.; eosinophils, 1 per cent. The urine shows specific gravity, 1.022; slight trace of albumin; no formed elements. Dr. Henry K. Pancoast made a roentgen-ray examination of the head (Fig. 4) and reported "sella turcica definitely smaller than normal, indicating a small pituitary body." An examination for the sugar tolerance made by Dr. A. H. Hopkins on February 12 resulted as follows: preformed sugar, 0.084; 100 gm. of glucose given by mouth showed:

½ hour after .....blood-sugar = 0.088
1 hour after .....blood-sugar = 0.104
1½ hours after .....blood-sugar = 0.090
2 hours after .....blood-sugar = 0.090
3 hours after .....blood-sugar = 0.106
4½ hours after .....blood-sugar = 0.086

No glycosuria occurred throughout.

A test for sugar tolerance was again made by Dr. Hopkins on April 19, after continued administration of pituitary extract during two months. This gave: preformed sugar, 0.060; 100 gm. of glucose given by mouth:

½ hour after .....blood-sugar = 0.110
1 hour after .....blood-sugar = 0.189
1½ hours after .....blood-sugar = 0.2
2 hours after .....blood-sugar = 0.151
3¼ hours after .....blood-sugar = 0.142

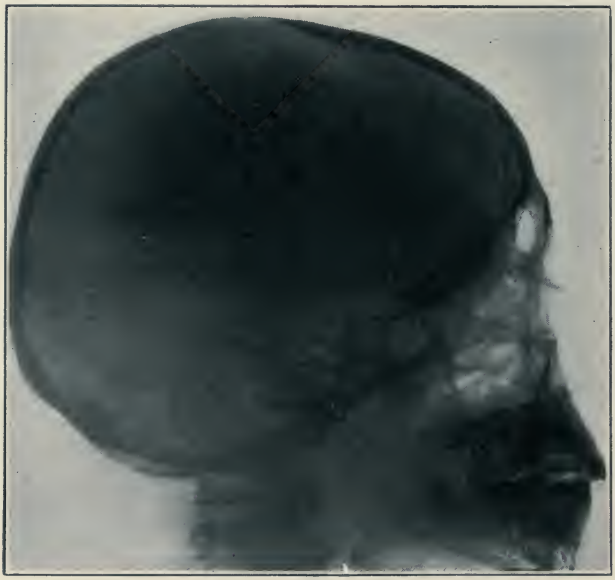

Fig. 4.—Pituitary infantilism; roentgenogram of skull showing small sella turcica.

Fehling's solution was decolorized at the end of 1 hour, 1½ hours and 2 hours. The test showed marked reduction in the sugar tolerance after the administration of pituitary extract. Examination by Dr. Edward Martin indicated that the limp in the left leg depended probably on a coxa vara.

The patient was given a low carbohydrate diet in limited amounts. On March 12 he was ordered a special diet of known quantities, starting with four eggs (180 gm.), milk (1,000 c.c.), cream (50 c.c.), bread (200 gm.), butter

(50 gm.), cream of wheat (200 gm.), sugar (16 gm.). This was varied from time to time to a slight extent, and meanwhile the child was made to exercise systematically in the hospital gymnasium. It is likely that he did not confine himself strictly to his diet, but ate other articles surreptitiously. In any event he was taken home May 30, having lost only 17 pounds.

This case represents an excellent instance of the hypopituitarism of Fröhlich, except in certain particulars. The infantile character of the sexual organs, the great obesity and its distribution, the tolerance for carbohydrates are positive indications. On the other hand, the subjects of Fröhlich's syndrome often exhibit a retarded skeletal development, while the case now reported possessed a decided overgrowth. This may depend, as Cushing has suggested, on activation of the anterior lobe of the pituitary body combined with insufficiency of the posterior lobe. The excessive action of the anterior lobe is the condition which, developing later in life, would result in acromegaly, but appearing earlier, as Brissaud suggests, produces gigantism. My patient was certainly of gigantic proportions for his age. Whether further growth would continue cannot be known. I regret that no roentgen ray studies were made of the developmental condition of the bones.

1810 Spruce Street.

DISCUSSION

DR. HERRMAN: It is extremely unfortunate that the term infantilism has sometimes been used so loosely. As originally defined, such patients presented besides a retardation in physical and mental development, an absence of the secondary sex characteristics. In this sense the so-called intestinal infantilism of Herter is not infantilism at all. It would be better to use the term dwarfism for those patients who present a retardation in physical development only. In all cases of suspected hypothyroidism, a roentgenologic examination of the carpal bones should be made. Such cases will show a retardation in the appearance of the ossification centers, and will improve on thyroid treatment. The present tendency is to use pluriglandular therapy in disturbances of the endocrine system.

DR. GRIFFITH: An examination of the bones was made and nothing abnormal was found in the first case. In the second case there was, I regret to say, no examination of the bones except of the skull. I cannot agree that the term infantilism is too broad, provided it is properly employed. We can well accept Hasting Gilford's definition that it is a slowness of bodily development, but not necessarily of growth; and that this slowness is most marked in the generative organs.

HEAD SHAKING WITH NYSTAGMUS IN INFANTS

A STUDY OF SIXTY-FOUR CASES

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NEW YORK

Nomenclature.—Various names have been given to this condition. Those which include the word spasm, such as spasmus nutans, nutatio capitis spastica, gyrospasm, nodding spasm, are objectionable, because it is not a spasm in the sense in which that term is usually used. The terms gyrospasm, rotatory spasm, head nodding and nodding spasm are inaccurate, because the movements may be in any direction. The term spasmus nutans has sometimes led to confusion with the condition known as eclampsia or epilepsia nutans, which is an entirely different disease. Salaam tic, a term sometimes used by French authors, is objectionable because this condition has none of the characteristic features of a tic. Everything considered, head shaking with nystagmus, seems to be the least objectionable name.

Historical.—This condition was first described by Ebert[1] in 1850, and in 1851 by Romberg and Henoch.[2] In 1890 Hadden[3] published two important papers, with a report of twenty-one cases. Caillé[4] of New York was the first to note that when the nystagmatic eye or eyes were bandaged, the movements of the head ceased. In 1897 Raudnitz[5] published his exhaustive monograph on the subject, based on fifteen cases, in which he particularly emphasized the importance of the dark room in the etiology of this condition. In 1911 he published a report on the production of this condition experimentally in young dogs. In England and Scotland, Still[6] and Thomson[7] have reported large series

1. Ebert: Charité-Ann., 1850, **1,** 752.
2. Henoch and Romberg: Klin. Wahrnehm. u. Beobact., Berlin, 1851.
3. Hadden: Lancet, London, 1890, **1,** 1293; St. Thomas Hosp. Rep., 1890, **20,** 205.
4. Caillé: Arch. Pediat., 1890, **7,** 171.
5. Raudnitz: Jahrb. f. Kinderh., 1897, **45,** 144; Jahrb. f. Kinderh., 1911, **73,** 259.
6. Still: Lancet, London, 1906, **2,** 207; Clin. Jour, 1906, **29,** 90.
7. Thomson: Jacobi Festschrift, 1900; Brit. Med. Jour., 1901, **1,** 763.

of cases. In this country Peterson,[8] Aldrich,[9] Abt,[10] Judson,[11] Miller,[12] Hamill and Posey,[13] Hill[14] and others have published cases.

Frequency.—This condition seems to be more common in some countries than in others, if we may judge by the number of reported cases. It is certainly more frequent in large cities. In Budapest at the children's clinic, 15 cases were observed in 3 years among 52,215 patients; in Prague, 8 cases in 2 years among 1,223 patients; in Edinburgh, 35 cases in 11 years among 21,752 patients; in Basel, 2 cases among 6,154 patients; in Christiania 10 cases were seen at the children's clinic in 10 years. The disease appears to be not uncommon in London, Edinburgh, Berlin; and in this country in New York and Philadelphia. During the last 19 years I have had 64 cases under my observation at various children's clinics in New York. The first 15 were seen during 1899, 1900, 1901, at the Good Samaritan Dispensary, chiefly in the service of Dr. Koplik. These figures would indicate that this condition is met with in New York City in about 1 in every 700 infants coming for treatment. The number of cases varies markedly in different years. In 1901 I saw 8 cases; in 1906, 9 cases; in 1910, 13 cases, and in 1918, 7 cases; whereas in some years, 1904, 1908, 1909, 1912, 1914, 1916, no cases were seen. This difference in the prevalence of the disease in different years has also occurred in other cities; for example, in Budapest, in 1891, there was one case in 17,400 patients; in 1894, 9 cases in 16,563 patients. It is relatively somewhat more common among negro children than among white children in New York. In 1910 I saw 10 cases in negro children at the Vanderbilt Clinic. This is probably due to the poor hygienic conditions and the greater prevalence of marked rickets in these children.

Sex.—Females are slightly more frequently affected. In my series, there were 29 males, 35 females. In 133 previously reported cases there were 62 males, and 71 females.

Seasonal incidence.—This condition shows a very distinct seasonal incidence, as shown in the accompanying tabulation.

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8. Peterson: New York Med. News, 1892, **61,** 374.
9. Aldrich: Am. Jour. Med. Sc., 1899, **177,** 158.
10. Abt: Jour. Am. Med. Assn., 1900, **34,** 269.
11. Judson: Arch. Pediat., 1899, **16,** 197.
12. Miller: Arch. Pediat., 1900, **17,** 561.
13. Hamill and Posey: Am. Jour. Med. Sc., 1904, **128,** 875.
14. Hill: Arch. Pediat., 1911, **28,** 974.

OCCURRENCE OF HEAD SHAKING WITH NYSTAGMUS BY MONTHS

Previously Reported	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
110 cases ..... Herrman	37	16	10	1	1	1	1	2	4	6	8	23
64 cases ..... Hours sunlight	20	12	6	1	2	0	1	2	2	3	4	8
Edinburgh (Thomson) ..... Hours sunlight	34	57	98	123	165	157	138	145	104	83	47	24
Average, 1911-1917..... New York, Herrman	140	177	223	220	270	288	279	265	243	200	177	151
Mean temperature												
Average, 1911-1917..... New York, Herrman	33.5	29.7	37.2	49.7	60.7	68.3	74.7	72.9	66.4	57.1	44.7	34.4

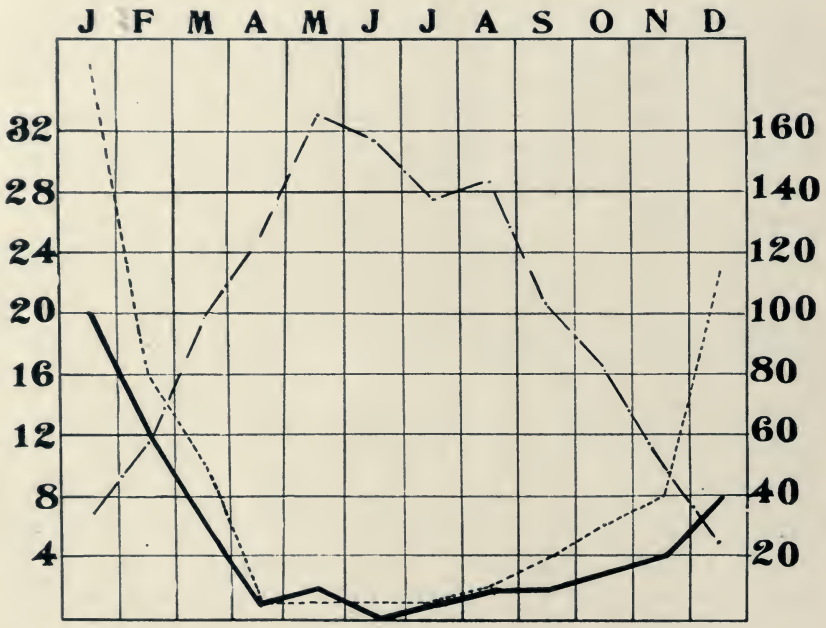

Fig. 1.—Seasonal incidence of head shaking with nystagmus; ———— sixty-four cases observed by the author; — — — — — 110 previously reported; —.—.—. number of hours of sunlight each month in Edinburgh (Thomson).

It will be seen, Figure 1, that it is much more prevalent during the winter months, nearly 70 per cent. of all cases occurring during December, January, and February. The largest number of these begin in January, and recurrences are almost always in this month. As Thomson has pointed out, the number of hours of sunlight, in temperate climates, is at its minimum during the winter months, Figure 2, and this may bear a definite relation to the prevalence of the condition. It may also account for the very few cases reported in France,

Italy, and Spain, for it seems very unlikely that the disease could be overlooked. However, it does not appear probable that the relation is a direct one, and there is no reason to suppose that the amount of sunlight bears a direct relation to this disease. It would be interesting to determine whether head shaking is rare in countries in which there is an unusually large percentage of sunshiny days, for example, New Zealand, and whether the condition is prevalent in the months of

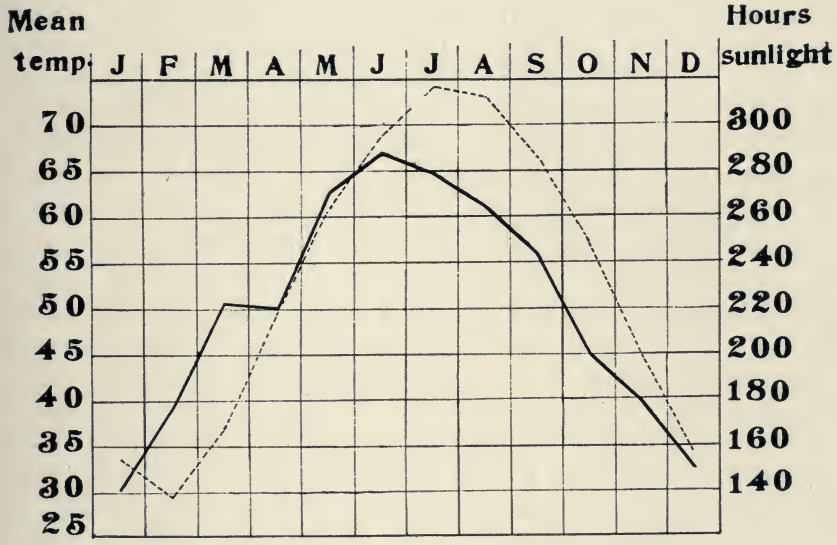

Fig. 2.—New York City, 1911-1917; ———— number of hours of sunlight; — — — — — mean temperature.

December, January, and February in places in which the summer and winter seasons are different than our own. It will be noted, Figure 2, that the incidence curve of head shaking also corresponds quite closely to the mean temperature curve, so that the temperature might also be important, in so far as during very cold weather the windows would be closed and the infants would not be taken out as much as usual. This may possibly account for the unusually large number of cases seen during the past winter, which was an extremely severe one.

Age incidence.—The disease is most common between 4 and 12 months of age, 75 per cent. of all cases occurring at that time. In my series the age of onset could be definitely determined in 61. It

was 1 at 1 month, 2 at 2 months, 2 at 3 months, 2 at 4 months, 3 at 5 months, 8 at 6 months, 8 at 7 months, 5 at 8 months, 5 at 9 months, 6 at 10 months, 4 at 11 months, 6 at 12 months, 2 at 13 months, 3 at 15 months, 1 at 20 months, 2 at 21 months, and 1 at 4 years. The youngest in the series was 1 month old. Schoenberg[15] has also reported a case at that age, and Gee[16] one at 6 weeks of age. After the eighteenth month a first attack is rare, but there may be recurrences at that time. In some of the late cases, the original attack may have been overlooked. My oldest patient was 4 years of age. Henoch reported a case of 3 years, Still one of 4 years, and Mowat[17] one of 5 years. It is pretty well established that head shaking is a developmental disease, and that it occurs in certain predisposed infants at a time when the associated movements of the head and eyes are being perfected.

Family history.—In very few of my series, was there a distinct neuropathic family history. In 2 instances the parents were cousins. In 4 cases the mother was extremely nervous, in 3 markedly anemic; 1 had frequent attacks of migraine; 1 had hysteria. In 5 families one or more of the other children had convulsions; in 1 family one child had epilepsy, and in another family a child died of meningitis. In one instance the condition occurred in twins, and in another family two children were affected. Henoch and Reyher also observed the disease in twins; and Thomson and Hadden have reported instances of more than one case in a family. Three of my cases occurred in mongolian imbeciles. Unlike the latter disease, head shaking does not attack more frequently the first or last child, and it is not more common in families in which there are a large number of children.

Previous history.—In three of my series, the labor was difficult and the delivery instrumental; one was a "twilight" baby, and one was prematurely born. None of these factors seem to play a part in the causation of head shaking.

Feeding.—At the onset of the disease, thirty-five of my patients were breast fed, eighteen artificially fed, and eleven were on mixed feeding, so that the character of feeding has no direct relation to the disease. As one would expect, the rachitic manifestations when pres-

15. Schoenberg: Norsk Mag. f. Lægevidensk., 1891, p. 467.
16. Gee: St. Barthol. Hosp. Rep., 1886, **22,** 96.
17. Mowat: Lancet, London, 1906, **2,** 397.

ent, were more marked in the artificially fed infants, so that to a certain extent such infants were somewhat more predisposed to head shaking.

Previous disease.—Illness, by lowering the vitality, apparently is an etiologic factor in those infants who are already predisposed. Five of my cases followed an attack of bronchitis, 3 followed pneumonia, 6 patients had digestive disturbances, 2 measles, and 1 each nasopharyngitis and otitis. Intercurrent disease tends to increase the head and eye movements.

Teething.—It is to be expected that this condition, which plays such an important etiologic rôle in the minds of mothers, should also be held responsible for head shaking. It would not be surprising if the nystagmus were ascribed to the eruption of the "eye" teeth. Ebert, Henoch, and Still, believe that the eruption of teeth often plays an important part as a source of peripheral irritation. In exceptional cases this may be so, but I have not been able to convince myself that the rôle is an important one. In 18 of my cases the onset of the disease antedated the eruption of teeth. Ebert, who first described the condition, writing in 1850, says, "It is well known that febrile and spastic conditions which are related to the eruption of teeth may antedate the actual appearance of the teeth." If we accept this statement, then anything is possible. I recently saw an infant in whom the eruption of two incisors occurred on the day on which a measles eruption appeared. To the lay mind it seems like cause and effect. In my patients teeth appeared during the course of the disease, but I never noticed an exacerbation of the symptoms at that time. *Fatigue* does tend to increase the symptoms, so that it is possible that a fretful child that is teething may sleep less, and in that way the head movements might become more distinct. Other sources of peripheral irritation, worms, otitis, etc., have been mentioned as causes, but the evidence is not conclusive.

Trauma. Fall.—In a small percentage of cases this may reasonably be considered an exciting cause in a predisposed child; but it must be remembered that a large number of infants fall and very few show any permanent injury. Only when the head shaking begins shortly after the fall can a relation be claimed; and it is also possible that the fall is a symptom of an already existing coordination neurosis rather than its cause. In six of my series there was a definite history of a fall just preceding the onset of the disease. In one of Hadden's

patients two relapses occurred following falls on the head. Peterson[8] says: "Perhaps a concussion of some kind may be found in most of the cases to be the determining factor—a concussion setting up in the centers of the spinal accessory and at times in those of the oculomotor nerves an arrhythmic discharge."

Hygienic conditions, social position, location of rooms.—The hygienic conditions and social position of the family play an important part. Many authors say that the disease does not occur among the well-to-do. This is not absolutely correct, as I have had two cases in families in comfortable circumstances, and Still mentions having seen three such cases. It is rare, however, among this class compared with the frequency with which rickets, laryngismus stridulus, tetany and convulsions occur in them. In large cities, head shaking is more common among those who live in the poorer tenement districts. In my series 11 families lived in the basement, 20 on the first floor, 9 on the second floor, 12 on the third floor, 7 on the fourth floor, and 5 on the fifth or top floor. It will be noted that one half of the families lived in the basement or on the first floor; those living in the basement were not only the poorest, but their rooms were dark and ill ventilated, and the intelligence of the mothers was lower than the average.

Dark rooms.—In 55 of the cases of my series the character of the rooms could be accurately ascertained. I visited nearly all of them myself. It is important to investigate oneself and to determine the exact conditions during the months preceding the onset of the disease. The crib may be placed in a dark corner of a room, not otherwise very dark; the shades may be drawn down a large part of the day so as to darken the room and favor sleep, or the crib may be curtained in order to prevent the light from shining in the infant's eyes. In 40 of my series, the infant was more or less in the dark, and in a large number of these cases it was necessary to use artificial light in the afternoon during the winter months. In the remaining 15 the room and the spot where the infant lay were fairly light, and in a few of these the room was bright even during the winter months. In several cases, although there was a light room, the infant was kept most of the time in the kitchen, a dark room, so that the mother could watch it while cooking; in several others it was impossible for the mother to take the baby out on account of sickness or the large number of other small children that required attention. On the other hand, in a few cases the mother definitely said that the baby was taken

out regularly. It must be remembered that in certain crowded sections of the city a large number of people live in dark rooms, so that only a small portion, probably not more than 1 in 100 infants living in such rooms, contract the disease. Here again we must assume an individual predisposition. The same has been noted in so-called miner's nystagmus; only 3.5 to 4 per cent. of all coal miners working under exactly the same conditions are affected. There can be little doubt that the dark room is an important factor in a large number of the cases of head shaking. During the last eleven years I have seen the same class of patients at the Lebanon Hospital outpatient department in the Borough of the Bronx as I saw during 1899-1902 at the Good Samaritan Dispensary on the Lower East Side of New York. Making due allowance for the difference in the number of patients, the disease was more common in the latter section, principally, I believe, because in the Borough of the Bronx the majority live in rooms which are better lighted and better ventilated. A series of 4 cases of head shaking reported by Rietschel[18] from Finkelstein's service is interesting. On account of the suspicion of communicable disease these 4 infants were transferred from the well lighted ward of the infant asylum to the dark room of a barracks. Shortly after, they developed head shaking. One of the infants was returned to the well lighted and well ventilated ward of the asylum and the head movements soon disappeared. Raudnitz was able to produce experimentally a similar head shaking with nystagmus in puppies by placing them in a dark cage at or very shortly after birth. In from six to eight weeks they developed nystagmus, and after three or four months, shaking of the head. If they were placed in a darkened cage *after* they were 2 months old, these symptoms did not develop. Here again we note, that the causative factors act only at a certain stage in the development of the nervous mechanism which controls the associated movements of the head and eyes. As in infants, at first the nystagmus was only seen when the animal looked in certain directions or when the head was held, and the head movements ceased when the eyes were bandaged. If the animals were placed in the open a few days after the nystagmus first showed itself, it disappeared in from one to two weeks, and if they were returned to the dark cage, the nystagmus reappeared in from two to seven days. If the animal was kept in the dark, however,

18. Rietschel: Charité-Ann., 1906, **30**, 152. Rietschel refers to John Thomson of Edinburgh, as an American. We should be very glad to claim him.

so that the nystagmus persisted for several months, it required as much as nine months' exposure to daylight to cause the nystagmus to disappear. The examination of the fundus, the vision, and the microscopic examination of the brain and retina of the affected animals showed no pathologic changes. It is worth noting that in Raudnitz' experimental work on animals the cage was dark and apparently there was no artificial light to which the eyes of these young animals was attracted. In explaining the causation of the condition in infants he laid stress on the straining of the eyes in looking at an artificial light some distance above the level of the head. Raudnitz believes that the nystagmus associated with the head shaking in infants is analogous to that observed in coal miners.[19] Although there are some points of analogy, there are some objections to this theory. The nystagmus of coal miners seems to be due to the strained position of the head, eyes, and body of the men, working in a place which is imperfectly lighted. The darkness alone is not sufficient, for this form of nystagmus occurs *only* in *coal* miners. The strained position of the head and eyes alone is not sufficient, for it does not occur in ceiling painters, and in others who have to look more or less constantly upward. A large percentage of the miners affected have errors of vision, while the infants with head shaking associated with nystagmus have no such error. The nystagmus of miners is usually bilateral and conjugate; that of the infants is usually unilateral, or is much more marked in one eye, and is frequently not conjugate. In miners head movements are uncommon and are only present in severe cases; in infants head movements are the rule. In miners the head movements do not cease when the eyes are bandaged as they do in the infantile form.

Rickets.—Kassowitz,[20] Hochsinger[21] and Stamm[22] consider the head shaking of infants a rachitic manifestation. In my series, 45, or 70 per cent., of the patients showed some manifestations of this disease. This is about twice as frequent as in other infants brought for treatment. Thomson's figures are 94.2 per cent. rickets in the affected infants, 46.9 in other infants. Of course the percentage of rickets will vary according to the clientêle. For example, in New York City,

19. Nieden: Nystagmus der Bergleute. Wiesbaden, 1894.
20. Kassowitz: Vorles. u. Kinderk. im alter d. Zahnung, Vienna, 1892, p. 165.
21. Hochsinger: Verhandl. d. Gesellsch. f. Kinderh., 1897, **14,** 238.
22. Stamm: Arch. f. Kinderh., 1902, **32,** 259.

rickets is much more common in negro children, so that it is not surprising that every one of my 10 cases of head shaking in negro children showed distinct rachitic changes.[23] However, in 19 of my cases rickets was not present, so that it cannot be an indispensable factor. Several other points indicated by Thomson are of interest. In head shaking, antirachitic treatment is not followed by the rapid improvement which we are accustomed to see in rickets. This has been my own experience and is contrary to that of Stamm, who noted distinct improvement in the head shaking *in a few weeks.* Cases of head shaking are rarely associated with laryngismus stridulus, facial irritability, tetany or convulsions. In my series, although many had marked rachitic manifestations, only 3 had laryngismus stridulus and facial irritability, and in Thomson's 35 cases only 2 had laryngismus stridulus and facial irritability. There does not seem to be a distinct relation between the frequency of laryngismus stridulus and head shaking in a given locality. In Vienna, Kassowitz in six years saw 370 cases of laryngismus stridulus, that is on the average 61 cases a year; in Edinburgh, Thomson in three years saw only 61 cases, that is, 20 a year. On the other hand, Kassowitz in eight years saw only 9 cases of head shaking; that is, about one a year, while Thomson saw 35 cases in eleven years; that is, 3 a year. If these conditions were due, as Kassowitz supposes, to the increased vascularity of the bones of the skull and the neighboring tissues, then we should expect that head shaking would be frequently present in rachitic infants with craniotabes; however, such is not the case. Rietschel tested the electrical reactions in 4 cases of head shaking, and 3 of the 4 gave normal reactions. While head shaking is rare in well-to-do families, rickets, laryngismus stridulus, tetany, and convulsions are not uncommon. As is well known, rickets involves not only the bones, muscles and ligaments, but the central nervous system as well, so that it is not surprising that a rachitic infant should be somewhat more predisposed to the development of a functional neurosis.

Pathogenesis.—Notwithstanding the great amount of investigation on this subject, the exact explanation of the disturbance of the nervous mechanism which results in the head and eye movements is still something of a puzzle. The solution requires the combined investigation of the pediatrist, neurologist, and ophthalmologist. Thomson says:

23. Herrman: Arch. Pediat., 1910, **27,** 370.

The nervous mechanism whose function is at fault is evidentiy that which includes the semicircular canals in its circuit, and which regulates the coordination of the movements of the eyes with those of the head. Dr. Alex Bruce tells me that the nucleus of Deiters (one of the end nuclei of the vestibular nerve, lying at the lateral angle of the fourth ventricle) is in all probability the seat of the disturbance. He infers this from its connection with the oculomotor nuclei and with the anterior cornua of the cord.

Henoch had about the same in mind when he wrote:

The frequent combination of head shaking with nystagmus is interesting, as it indicates that the nuclei of the spinal accessory and the upper spinal nerves which supply the affected muscles of the head and neck, are in close relation to those of the eye muscles.

The most satisfactory explanation of the pathogenesis of this condition is that originally suggested by Hadden and later modified and amplified by Mills[24] and Aldrich. Mills says:

Hadden believes that the symptoms point to an instability of the motor centers above the nuclei in the spinal cord and fourth ventricle, and he would therefore attribute the disorder to a functional or other disturbance of the cerebral cortex. The child has acquired certain voluntary or purposive movements of the head and eyeballs, but these have not as yet become thoroughly organized and fixed in the psychomotor areas of the brain, hence a dissolution takes place because of the instability of the strained cortical centers to stand the work to which they have been too early subjected.

Aldrich amplifies this as follows:

The writer in considering the pathology of these cases accepts as a fact the obvious relation of the head and eye movements, hence we have to consider an automatic head and eye movement in a child of unstable nerve development, and at an age in which the associations of those necessary movements are being educated and fixed in the psychomotor areas of the brain. Anyone that has observed the head and eye movements of the infant cannot have failed to mark the incoordinated attempts at associated movements of the head and eyes. The fibrous connection between the visual areas of the cerebral cortex and the fovea centralis that is necessary to perfect vision does not fully develop until after birth, and only gradually becomes medullated and fit for function. After this process is completed, which takes place only when the cortical cell has attained a degree of maturity that provides ample nutrition for its axis cylinder, then the structural and physiologic integrity of the central neuron is complete. During this time the same process of development in the peripheral neuron is going on with even greater rapidity, and we have the beginning of one of the most wonderful and mysterious processes of the nervous system—the communication between the central and peripheral neuron. . . . Binocular adjustment, judgment of fixed objects, spatial relations, including station, are acquired by the child as the medullation progresses. If this progress of medullary development of the nerve supply of the eyes is

24. Mills: Am. Textbook Dis. Child., Ed. 2, 1894, p. 712.

either interfered with by disturbance of nerve nutrition or rendered functionally imperfect through early acquired opacity of the refracting media, or by congenital absence of a place in the retina that has more acute and perfect vision than elsewhere (fovea centralis), or a congenital defect in the receptive center in the cortex, or an exhaustion of any of that delicate apparatus, then we are liable to get a rapid to and fro movement of the eyes—nystagmus.

Symptoms. Movements of the head.—The movement of the head is usually the first manifestation noticed by the mother, but in a certain number it may be preceded by a peculiar "cocking" of the head to one side. In some the nystagmus may precede the head movements but may not be noticed because it is present only when the child looks in certain directions, or when the head is held. The muscles chiefly affected are the sternocleidomastoid, the trapezius and the rectus capitis. The movements are regular and rhythmical and from 60 to 100 a minute. Usually they are not continuous, but come on at longer or shorter intervals. The direction is rarely purely horizontal, vertical or rotary, but when primarily horizontal, slightly upward to one side and downward to the other, the excursions often being greater to one side. If primarily vertical, it is rarely a pure nod forward and backward. The movement may be a combination of the horizontal and vertical, and they may be in different directions at different times. In my series the movements were primarily horizontal in 44, vertical in 12, rotary in 4, and horizontal or vertical at different times in 4. The movements are often more distinct when the child is angry or fatigued, and during an attack of some intercurrent disease. They cease when the child is lying down and in sleep. There is, however, an occasional exception to this rule; for example, in one of my cases, in which the movements were unusually frequent and well marked, they continued when the child was lying down, and Amberg[25] also mentions a case in which the movements continued during sleep. It was first noticed by Caillé, and later by Raudnitz, that the movements of the head ceased when the eyes were bandaged. It is not possible to test this in all patients, because some object so strongly that the movements of the head due to anger prevent the drawing of definite conclusions; but in 14 of my cases, I was able to corroborate this statement. The movements of the head are best seen when the infant is gazing in the distance and is not interested in any particular object. If an object is brought within a short distance, so that it is definitely fixed, the movements of the head cease.

25. Amberg: Arch. Pediat., 1901, **18,** 831.

Movements of other parts of the body.—I have not observed movements of the extremities, such as described by Thomson, Still, and others, or of the trunk, as reported by Hadden. Ausch[26] noticed in one of his cases movements of the hands, as if the child was vexed. I have frequently seen such movements in infants who were entirely free from head shaking.

The peculiar position of the head.—(Fig. 3).—About one-half of these patients have a peculiar way of "cocking" the head to one side and looking out of the corners of the eyes. This may precede the head movements and may persist after these movements have ceased. In 75 per cent. of the infants in whom this "cocking" was present the

Fig. 3.—Peculiar cocking of the head seen in infants affected with head shaking with nystagmus.

head was inclined to the left. This is noteworthy in connection with the fact that in sixteen of the twenty-three cases in which the nystagmus was unilateral, the left eye was affected. Some of the patients have a habit of looking down with a coy expression; others throw the head back and look out of the partially closed lids.

Movements of the eyes.—The nystagmus may appear before, simultaneously with or after the head movements. It may persist after the head shaking has ceased. In 35 of my cases the nystagmus was bilateral, in 23 unilateral. Of the latter, 16 affected the left eye, 7 the right eye. Even when the nystagmus was bilateral, it was frequently more marked in one eye. In 6 cases the nystagmus was not seen when the patients were examined in the ordinary way, but it is

26. Ausch: Arch. f. Kinderh., 1900, **28,** 161.

known that in some cases the nystagmus is so slight that it can only be detected by an ophthalmoscopic examination. The direction of the nystagmus is often not purely horizontal, vertical or rotary; it may be different in the two eyes, or when the patient looks in different directions. In the 58 cases in my series in which nystagmus was present, it was primarily horizontal in 36, vertical in 6, and rotary in 15; in the remaining case it was impossible to determine the direction. The movements of the eye are much more rapid than those of the head, about 200 to 300 a minute. The nystagmus is increased by holding the head, and is more distinct when the child looks in certain directions, usually when it looks upward and to the right, when the right eye is affected, and upward and to the left, when the left eye is affected. It is also more distinct when the child fixes an object at a short distance, and when the eyes are converged. It is not present during sleep, as I was able to determine in several infants that I examined. When the nystagmus is bilateral it is not necessarily conjugate. According to Thomson,[7] it differs from other forms in that the pupils alternately approach and recede. Spicer[27] was not able to verify this in all of his cases. Thomson also says that in rotary nystagmus the center of the pupil does not describe a circle, but an ellipse or an irregular figure. The movements of the head are not simply compensatory to those of the eyes, for the rate is different, and the two are not necessarily in the same direction; for example, the movements of the head may be vertical, while those of the eyes are horizontal. The nystagmus may persist after the head movements have ceased, and it may recur without the appearance of head movements. In exceptional cases the nystagmus may be the only manifestation. Such cases may be regarded as atypical or incomplete. In 4 of my series, convergent strabismus was present; in 3 there was hippus; 3 had associated movements of the upper lids, "nictitation;" and in 2 there was some sensitiveness to light; 12 of my patients were examined by ophthalmologists, and none of these showed any changes in the fundus, defects of vision or opacities in the media. Similar examinations reported by other authors were also negative, except that in two of Hadden's cases the fundus was light colored, and in one a slight crescent of atrophy was present around the left disk. In a few of my patients, I instilled homatropin in order to paralyze accommodation. The nystagmus was diminished, but the head movements con-

27. Spicer: Brit. Med. Jour., 1901, **1**, 1120.

tinued. This is what one would expect, for as previously mentioned, the head movements cease when an object is distinctly seen and fixed; by paralyzing accommodation this becomes impossible. As nystagmus is sometimes associated with disturbances in the semicircular canals, Raudnitz had the ears examined in several cases. None showed any lesions, and syringing of the ears had no especial effect on the nystagmus.

Associated conditions. — In my series, 6 patients were anemic, 5 had an enlarged spleen, 2 tuberculous lesions, 2 papular urticaria, 2 eczema, 3 a geographical tongue, 1 blepharitis ciliaris. One child had attacks of apnea. Hadden reports cases with attacks of unconsciousness, partial or complete, and convulsions. Such cases are rare, and the more severe probably represent cases of so-called epilepsia nutans.

Duration.—The condition seldom lasts less than 2, or more than 12 months. In my series, the duration of 50 cases could be determined. In 6 it was 3 months; in 6 it was 4 months; in 12 it was 5 months; in 6 it was 6 months; in 4 it was 7 months; in 4 it was 8 months; in 2 it was 9 months; in 4 it was 10 months; in 6 it was 12 months. In 3 there was a recurrence during the following winter, 2 in January and 1 in February. In exceptional cases, however, the disease may last for more than one year. Spicer mentions a case in which it was present at 4½ years of age; and another in which the nystagmus persisted at 13 years of age.

Subsequent history.—I have been able to follow 15 of my cases for a period of from two to ten years. Of these, 8 had no subsequent disease that had any relation to the head shaking. Of the remaining 7, 2 had enuresis, one of these until she was 6 years of age; 1 had convulsions; 1 pavor nocturnus; 1 a facial tic; 1 was extremely sensitive and also anemic; and 1 was a very restless sleeper and had grinding of the teeth. With the exception of the 3 cases in mongolian imbeciles, all the children showed a normal average mental development. I recently saw a girl of 13 years with a mild type of exophthalmic goiter (Graves' disease) who had had head shaking in infancy. In none of the 5 children who were followed to the eighth year did chorea develop. This is of some interest, as several authors have thought that there was a possible relation between these two diseases.

Diagnosis.—The principal features of this condition are so characteristic that the correct diagnosis is seldom difficult. Some of the earlier authors confused it with *eclampsia* or *epilepsia nutans,* which is

really an epileptic equivalent. This disease occurs in attacks, and is associated with partial or complete unconsciousness. There is no nystagmus. In head shaking there are no sudden attacks, the movements are more or less continuous, and consciousness is not lost. The movements in head shaking are entirely different from those of a *tic* or *habit spasm.* They are smooth, regular, and rhythmical, not jerky. Tics do not occur at such an early age, and they are not associated with nystagmus. The *rocking* movements of the trunk and head, frequently seen in infants and young children, have only a remote resemblance to head shaking. The movements are voluntary, and even when they are not a manifestation of masturbation, seem to give the patients a certain amount of pleasure or satisfaction. Nystagmus is absent. Head shaking has occasionally been confused with the nocturnal movements of the head, *Jactatio capitis nosturnia,* which is sometimes seen in older children. These movements differ from the head shaking of infants in that they occur during sleep, or at least in a subconscious state, and are not associated with nystagmus. *Head rolling,* like head shaking, is seen in rachitic infants, but it is only present when the child is lying down; it is a voluntary act, and it is not associated with nystagmus. There is a rare form of *congenital head shaking with nystagmus* which is due to pathologic changes in certain areas of the brain. This condition as well as a number of other diseases of the central nervous system, associated with head movements or nystagmus, can easily be differentiated from the benign head shaking of infants, by the fact that the disease is progressive and persists throughout life. In all these conditions when nystagmus is present it is bilateral and conjugate.

Prognosis.—Head shaking with nystagmus in infants is a benign disease; all patients recover. The mothers may be assured that this disease will not interfere with the general health, or with the future mental and physical development of the child. The disease usually begins in the winter months and disappears during the following summer. Occasionally there is a recurrence of symptoms the following winter, but this also is of short duration. A few of the patients show a neuropathic tendency in later childhood.

Treatment. — The general condition, the hygienic surroundings, should be improved if possible. The room should be light, and the patient should be kept in the open air as much as possible. In several of my cases the mother noticed that there was a rapid improvement

when the child was taken to the country. If there are any sources of peripheral irritation, these should be removed; if there are digestive disturbances, the diet should be regulated. Those infants that present rachitic manifestations should receive phosphorus and cod liver oil. In most cases this treatment is sufficient. I have not seen any marked improvement following the administration of bromids, belladonna or arsenic.

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DISCUSSION

DR. CAILLÉ: About twenty-five years ago I read a paper before this Society on head nodding associated with nystagmus, and I demonstrated that if the child's eyes were tied up the head nodding would stop. I assumed that in the presence of nystagmus the child has difficulty in focussing, and that the head follow the eyes in the attempt to focus. Ophthalmologists did not agree with me on this point, and I believe it still remains to be cleared up.

DR. HERRMAN: I merely want to say that I have given Dr. Caillé credit for the point he has made in his discussion. It acts in every case in which I have tested it. I have found that in every instance in which the child's eyes have been bandaged the head movements stop. In some cases it has been impossible to do this on account of the struggling of the child, but in every instance in which it has been done the fact was verified.

VARIATIONS IN THE LIPOID ("FAT") CONTENT OF THE BLOOD OF INFANTS UNDER CERTAIN NUTRITIONAL CONDITIONS*

W. McKIM MARRIOTT, M.D. AND WARREN R. SISSON, M.D.
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Clinical experience has shown that without a certain amount of fat in the food of an infant, normal growth is not be be expected. Excessively high fat feeding, on the other hand, may overtax the assimilative functions of the body and lead to most serious consequences. Thus intestinal indigestion with diarrhea and a lowering of the tolerance for all food is, at times, the result of an excessive amount of fat. Failure to gain weight, constipation, the conditions variously described as "Chronic Fat Indigestion," "Milchnährschaden," "Bilanzstörung," have all been attributed to relative or absolute excess of fat in the diet.

The infant fed on considerable amounts of fat, but unable to utilize this fat, is virtually in a state of fat starvation. Analyses of the stools for fat or its derivatives gives us some information as to the efficiency with which fat of the food is digested and absorbed. Further information as to the behavior of fat in the body of the infant can be obtained from a study of the fat of the circulating blood under varying conditions of feeding and states of nutrition.

If the fat of the blood represented only absorbed food fat on the way to the tissues, blood fat determinations would give us a reliable index of the amount of fat digested and absorbed. The process is not so simple, however, on account of the fact that the fat of the blood is derived from the tissues as well as from the food and there is no method at present available that will serve to differentiate the source of the fat. It has been shown that animals during complete and prolonged starvation may have as high a fat content of the blood as those fed on diets containing moderate amounts of fat.[1]

The reason for this is made clear when we consider the physiology of fat metabolism. Fat is absorbed largely by the mesenteric lymphatics and reaches the blood stream by way of the thoracic duct. There

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* From the Boston Floating Hospital.

1. Bloor, W. R.: Jour. Biol. Chem., 1914, **19**, 1.

is reason for believing that this fat must be altered in some way; for example, the change from single to double bond linkages at places in the fatty acid molecule,[2] before it can be "burned" in the body. The view at present most generally accepted is that these preparatory changes take place in the liver, and that whatever part of the ingested fat is immediately needed for fuel requirements is intercepted by the liver and converted into the combustible form. The remainder is transported by the blood to the fat depots of the body, in the subcutaneous tissues and elsewhere, and there deposited. These deposits may be drawn on from time to time as the body may require, and the fat transported by the blood stream back to the liver and subsequently burned.

It is thus evident why, during starvation, when the fat depots are drawn on, there may be considerable amounts of fat in the blood stream. If, however, fat is being burned in an efficient manner the amount in the blood stream would not be expected to rise to an excessively high point, and this, indeed, corresponds to the observed facts. As some fat is always being burned there is always fat in the blood, coming either from the intestine or from the fat depots. In normal adults the amount of fat does not vary greatly except following the feeding of considerable fat. If the fat were absorbed from the intestine at the same rate at which it was utilized in the body the blood fat percentage should not change very much. If fat absorption were more rapid than utilization, a high blood fat would result and the excess would be deposited in the fat depots.

A similar condition occurs when fat is drawn from the fat depots more rapidly than it can be utilized. This happens under certain pathologic conditions and the excess fat is deposited in the liver. In general, high fat in the blood means a deposition of fat somewhere in the body.

In order to interpret the analyses of blood for fat it is necessary to know the diet of the patient. An infant fed reasonable amounts of carbohydrate and protein would not be starving; consequently the fat depots would not be called on to as great an extent as during starvation. As a result, blood fat would not be as high as during complete starvation. If a certain amount of fat were added to the diet and none were absorbed, blood fat would remain low. With absorption, however, blood fat would be expected to rise. Hence, of two infants on the same feedings, the one digesting and absorbing fat would

2. Leathes: The Fats, London, 1913.

be expected to show the higher blood fat. Further, the one with the higher blood fat should be depositing fat in the subcutaneous tissues and other fat depots and therefore gaining weight. We have endeavored to determine if this is actually the case; that is, whether infants gaining weight have higher blood fat percentages than those who are stationary or losing in weight.

The nutritional condition of an infant may be considered from two standpoints, the first of which has just been mentioned, and may be referred to as the nutritional *trend* or direction of the weight curve; the second, the nutritional *state,* or weight of the baby as compared with what his weight should be at his age. One of the striking differences between a well nourished and a poorly nourished infant is the amount of subcutaneous fat. Is this in any way proportional to the blood fat? We have investigated this question.

Methods of Study.—The infants investigated were patients in the wards of the Boston Floating Hospital. Most of the patients in this hospital were under 1 year of age and suffering from disorders of nutrition rather than from acute illnesses. Some infants recovering from mild ailments and the infants of wet nurses gave us the necessary "normals" for comparison. It was through the courtesy of Dr. Henry I. Bowditch, medical director, and Drs. Paul W. Emerson and E. W. Barron, visiting physicians, that we were given the opportunity to study the patients from their respective services.

Blood was obtained by venous or sinus puncture, and the fat (total lipoids) determined by Bloor's nephelometric method.[3] "Fat" determined by this method includes the higher fatty acids whether originally combined as neutral fats, as lecithin, or as cholesterol esters, and in addition all of the cholesterol. No effort was made to separate these individual components, as it seemed likely that the desired information could be obtained as well from the total fat determination.

In all, fifty-two determinations of blood fat from forty-eight different infants were made. In Table 1 is given the essential information concerning each case, together with the results obtained.

In the column headed "Nutritional State" (Table 1) the letters refer to the state of nutrition as determined by a comparison between

3. Bloor, Walter R.: Jour. Biol. Chem., 1914, **17,** 377. Part of the analytical work was performed in Dr. Bloor's laboratory in the Department of Biological Chemistry of the Harvard Medical School. We are greatly indebted to Dr. Bloor for his aid and helpful suggestions.

TABLE 1.—DATA OF AUTHORS' CASES

No.	Age in Mos.	Weight Lb.	Weight Oz.	Nutritional State	Nutritional Trend	Feeding Fat	Feeding Carb.	Feeding Prot.	Calories per Kg.	Hours After Feeding	Blood Fat, per Cent.	Remarks
1	5	14	4	A	+	2.0	7.0	2.0	95	4	0.81	No disease
2	3	12	11	A	+	Breast fed			?	3	0.76	No disease
3	2	10	0	A	—	Breast fed			?	3	0.74	Syphilis; under treatment
4	18	21	4	A	±	0.0	4.5	3.2	45	3	0.66	Infectious diarrhea; convalescent
5	15	19	0	A	—	Buttermilk			65	4	0.66	Infectious diarrhea; acidosis
6	4	12	10	A	—	0.0	5.0	0.0	20	2	0.60	Intestinal indigestion; convalescent
7	18	21	0	A	—	Starving			0	12	0.57	Infectious diarrhea; acidosis
8	4	10	10	B	—	Starving			0	24	0.83	Severe diarrhea; acidosis
9	..	..	..	B	+	Breast fed			?	4	0.83	No disease
10	1	6	12	B	+	Breast fed			?	2	0.68	Syphilis; under treatment
11	6	13	4	B	—	Starving			0	36	0.67	Severe diarrhea; acidosis
12	10	14	6	B	—	0.0	5.0	0.0	50	2	0.52	Infectious diarrhea
13	2	7	9	B	—	1.2	5.4	1.0	65	2	0.52	Gastro-intestinal indigestion
14	1	5	14	B	—	Breast fed			?	4	0.60	Gastro-intestinal indigestion; mild
		5	7	C	+	Breast fed			?	4	0.77	Same child; recovered; week later
15	9	12	4	C	+	Breast fed			?	3	1.00	Pyelitis; convalescent
16	10	12	3	C	—	Starving			0	36	0.80	Severe diarrhea; acidosis
17	10	..	..	C	—	Starving			0	12	0.71	Severe diarrhea; acidosis
18	4	9	6	C	—	Starving			0	12	0.70	Severe diarrhea; acidosis
19	2	6	9	C	±	2.0	6.0	1.6	125	2	0.58	Intestinal indigestion; convalescent
20	3	7	8	C	+	2.0	6.0	1.6	125	3	0.64	No disease
21	1	5	14	C	+	1.4	6.0	1.2	100	3	0.64	Intestinal indigestion; convalescent
22	4	8	4	C	±	1.0	4.0	1.6	90	4	0.62	Syphilis; under treatment
23	2½	7	9	C	±	2.0	7.0	1.6	110	2	0.61	No disease
24	5	9	0	..	—	Protein milk			65	4	0.58	Intestinal indigestion
25	2½	6	14	C	±	Allm't mixte.			?	4	0.50	Intestinal indigestion
		7	0	C	+	Allm't mixte.			?	4	0.80	Same child recovered; week later
26	3	6	0	D	—	Starving			0	48	0.96	Severe diarrhea
27	4	8	7	D	—	Protein milk			40	2	0.71	Marasmus; nutritional edema
	4½	8	9	D	+	2.0	6.0	1.6	125	4	0.84	Same case; doing well
28	4	7	3	D	+	2.0	6.0	2.2	120	2	0.74	Syphilis; under treatment
29	11	12	0	D	—	2.0	6.0	1.6	100	4	0.73	No disease
30	3½	6	13	D	±	1.2	6.0	1.2	100	2	0.71	No disease
31	6	7	12	D	+	1.0	6.0	1.6	140	2	0.74	No disease

TABLE 1.—DATA OF AUTHORS' CASES—(*Continued*)

No.	Age in Mos.	Weight Lb.	Weight Oz.	Nutritional State	Nutritional Trend	Feeding	Calories per Kg.	Hours After Feeding	Blood Fat, per Cent.	Remarks
32	3½	7	7	D	±	2.0 6.0 1.6	110	2	0.71	No disease
33	2	5	14	D	—	Starving	0	12	0.52	Acute intestinal indigestion
	2½	5	5	D	—	1.0 5.0 1.2	90	4	0.70	Same case; recovering
34	4	..	..	D	±	0.4 2.2 1.6	...	2	0.70	No disease
35	12	9	0	D	+	0.0 4.5 3.2	75	2	0.70	Intestinal indigestion; convalescent
36	2½	..	..	D	—	Starving	0	?	0.70	Marasmus; moribund
37	6	9	0	D	—	1.6 6.0 1.2	120	2	0.70	Mongolian idiot
38	12	12	8	D	±	Soft diet	120	4	0.70	Anemia pseudoleukemica
39	3	5	4	D	±	Breast milk	120	4	0.70	No disease
40	3	6	8	D	+	2.0 7.0 1.6	125	2	0.67	No disease
41	2	5	8	D	—	Dil. breast milk	70	2	0.64	Marasmus
42	1	4	12	D	±	1.6 7.0 1.2	120	2	0.64	No disease
43	11	10	8	D	—	0.0 4.5 3.2	70	2	0.62	Rickets
44	10	9	11	D	±	Protein milk	125	2	0.61	Intestinal indigestion
45	3	6	5	D	—	3.0 5.0 1.2	125	4	0.65	Intestinal indigestion; convalescent
46	5	7	15	D	—	Buttermilk	50	3	0.60	Intestinal indigeston
47	5	7	4	D	—	Protein milk	70	3	0.58	Intestinal indigestion
48	7	11	14	D	±	2.0 6.0 2.8	120	4	0.52	No disease

the weight of the infant and the average weight of normal infants of the same age. The infants were arbitrarily divided into four classes as follows:

Class A, 85 to 100 per cent. of average normal weight.
Class B, 70 to 85 per cent. of average normal weight.
Class C, 60 to 70 per cent. of average normal weight.
Class D, below 60 per cent. of average normal weight.

In the column headed "Nutritional Trend" the signs refer to the general direction of the weight curve at the time of taking of the blood sample. Infants gaining in weight are classed as +, those stationary as ±, and those losing —. Feeding formulas are expressed roughly in percentages. The total food intake, in terms of calories per kilo, appears in a separate column and serves to indicate the amount of each formula taken during the twenty-four hours.

As indicated in the table, blood samples were drawn two, three, or four hours after the last feeding, excepting, of course, the infants who were starving. With one or two exceptions the infants studied were on a four-hour feeding interval.

Comparing different infants falling in the same general nutritional class and on similar diets, we were unable to detect any differences in the blood fat that could be attributed to the time of taking of the samples. This is easy to understand when we consider that fat digestion and absorption in the infant is a relatively slow process. The stomach is often not emptied until three hours after a meal, and even when feeding is at four hour intervals, fat absorption from the intestine must be an almost continuous process. Conditions in infants are vastly different from those obtaining in the dogs studied by Bloor.[1] These animals were fasted and then fed on pure olive oil. The blood fat rose gradually and reached a maximum at the end of about six hours. Had the animals been fed every four hours, the curves would have been expected to overlap and approach a continuous line. Furthermore, our infants were fed only on rather low fat percentages and on small total amounts as compared to the dogs.

Inasmuch as the taking of the blood sample does not seem to influence the blood fat percentage, in subsequent classifications in this paper no particular attention will be taken of the time interval. Furthermore, in each class of children studied, blood samples were taken at intervals which averaged approximately the same, therefore eliminating any effect of the time interval.

Nutritional state and blood fat.—In Table 2 the results on blood fat are arranged in groups according to the nutritional condition of the infants.

From the results (Table 1) it is apparent that *blood fat is independent of the state of nutrition of the infant.* Subcutaneous fat does not necessarily bear any relation to circulating fat. This is not surprising, as fat in the tissues represents fat deposited at some past time. A well nourished baby with plenty of subcutaneous fat may be losing weight and not storing up any fat; on the other hand, a thin baby may be laying on fat and have a blood rich in food fat on the way to the tissues. The important question in the nutrition of an infant is not so much whether he is fat or thin, but whether or not he is gaining weight.

Nutritional trend and blood fat.—Considering the infants studied from the standpoint of their weight curves, and dividing them into

groups, it is seen that infants gaining show, on the average, a distinctly higher blood fat than those whose weight is stationary or who are losing. The results appear in Table 3.

Particularly interesting are the results obtained on the blood of the same infant during gaining and during stationary or losing periods. (Table 1, Patients 14, 25, and 27).

In Table 3 are included *all* blood fat determinations that we have made. It may appear better to eliminate those patients who were fasting. If this is done the average for the stationary group becomes 0.63, and for the losing group 0.64, figures essentially the same as those

TABLE 2.—GROUPED BLOOD FAT PERCENTAGES

Nutritional State	A	B	C	D
Blood fat, per cent.	0.60, 0.74, 0.66, 0.81 0.66, 0.57, 0.76	0.83, 0.52, 0.52, 0.68 0.67, 0.60, 0.83	0.50, 0.80, 0.64, 0.80 1.00, 0.58, 0.71, 0.70 0.58, 0.64, 0.61, 0.77 0.62	0.70, 0.70, 0.73, 0.71 0.52, 0.70, 0.62, 0.58 0.70, 0.64, 0.74, 0.52 0.70, 0.74, 0.65, 0.71 0.84, 0.71, 0.67, 0.64 0.60, 0.61, 0.70, 0.96 0.70
Average	0.68	0.66	0.69	0.68

TABLE 3.—NUTRITIONAL TREND AND BLOOD FAT

Nutritional Trend	Gaining		Stationary	Losing
	Breast Fed	Artificially Fed		
Blood fat, per cent.	0.83, 0.77, 0.68 1.00, 0.80	0.64, 0.70, 0.81 0.74, 0.74, 0.84 0.64, 0.67	0.70, 0.50, 0.71, 0.66 0.64, 0.52, 0.58, 0.71 0.76, 0.61, 0.61, 0.70 0.70, 0.62	0.73, 0.80, 0.52, 0.70 0.60, 0.62, 0.74, 0.58 0.70, 0.83, 0.58, 0.52 0.66, 0.52, 0.70, 0.65 0.71, 0.71, 0.70, 0.57 0.64, 0.60, 0.67, 0.96 0.60
Average	(0.82) 0.76 (0.72)		0.64	0.66

obtained without eliminating the starving patients. In general, then, *an infant who is gaining weight, no matter what the state of his nutrition, will have a higher average blood fat than one who is not gaining.*

Blood fat and character of the feeding.—It is well known that infants are better able to "tolerate" the fat of breast milk than of cow's milk. If fat digestion and absorption are better when breast milk is fed, one might expect breast fed infants to show a high blood fat and a rapid gain in weight. In our group of infants who were gaining weight, those fed entirely, or in part, on breast milk showed an average blood fat percentage of 0.82, a considerably higher figure than any other group of infants in our series (Table 3). *Breast fed infants gaining weight have high blood fat percentages.*

As none of the infants studied was on "top-milk" mixtures, we are unable to state the effect on the blood fat of feeding artificial formulae with high fat percentages. We did have, however, a number of infants on formulae containing little or no fat, and these showed a lower average blood fat than any other group of cases studied (Table 4).

TABLE 4.—INFANTS ON FORMULAE CONTAINING LITTLE FAT

Character of Feeding	Fat Free	Starvation	Acidosis
Blood fat, per cent.	0.70, 0.70, 0.62, 0.60 0.66, 0.66, 0.52, 0.60	0.80, 0.52, 0.70, 0.83 0.72, 0.70, 0.57, 0.67 0.96, 1.02	0.80, 0.83, 0.72, 0.70 0.67
Averages	0.63	0.75	0.74

An infant on a fat-free diet is absorbing considerable food and hence there is not as great a demand on the fat deposits as during complete starvation; at the same time no fat is being absorbed, so that conditions favor a low blood fat.

During complete starvation blood fat figures are relatively high (Table 4, second column), as might be expected. The significance of this has already been discussed.

The majority of the infants starved were suffering from severe diarrhea; the general symptomatology approaching the clinical picture of so-called "intoxication." Five of these infants showed definite evidences of acidosis; there was hyperpnea, a lowering of the carbon dioxid tension in the alveolar air, and a diminution of the alkali reserve.

The acidosis was of the type described by Howland and Marriott.[4] that is, an acidosis not due to the acetone bodies. It is interesting to note that, as a group, these cases of acidosis showed no higher blood fat than the group of starving infants without acidosis of a significant degree. It has been shown by Gray[5] that in diabetes a high blood fat percentage usually occurs with acidosis. It would seem likely that in infants of the type described the failure of blood fat to rise may be due to the peculiar nature of the acidosis, it being of an entirely different origin from diabetic acidosis.

It is interesting to note that the average blood fat of the forty-eight infants that we have studied is somewhat higher than the results obtained from normal adults by Bloor.[6] He found an average blood fat of 0.59 as compared with our figures of 0.68. Blood from the adults studied was drawn before breakfast and therefore the effect of feeding fat was eliminated, and at the same time the fast was not of sufficient length to use up the carbohydrate stores to such a great extent as to call out much fat from the fat depots. The figures that Bloor obtained might be considered minimum rather than average for the twenty-four hours. A further explanation of the differences lies in the fact that the adult is usually in a state of weight equilibrium, whereas the normal infant is gaining. The infant ingests more fat per unit of body weight than the adult, and would therefore be expected to have constantly more fat in the blood stream on the way from the intestine to the liver and fat depots.

The fact that certain groups of infants show amounts of blood fat which vary distinctly from the general average of other groups suggests the desirability of further and more intensive work on special types of nutritional disorders from the standpoint of blood fat. It would be of especial interest to study further the particular group of cases in which failure to thrive has been attributed to difficulties in the digestion and absorption of fats.

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DISCUSSION

DR. DUNN: I would like to ask a question. Very often we have an infant that is gaining weight on a fat-free diet. What was the result of blood fat in these cases?

DR. TALBOT: Did you try to find any connection between high carbohydrate feeding and blood fat?

4. Howland and Marriott: Am. Jour. Dis. Child., 1916, **11,** 309.
5. Gray, H.: Boston Med. and Surg. Jour., 1918, **178**, 16.
6. Bloor: Jour. Biol. Chem., 1916, **25,** 577.

DR. HELMHOLZ: In regard to acidosis: In the children that have large fat deposits, are these drawn upon? Is it only those who have large fat deposits in the organs that show a high blood fat?

DR. MARRIOTT: In reply to Dr. Dunn's question, I did not have any infants in this series gaining weight on low fat feeding. In one or two instances a gain in weight was found to be due to edema, which eliminated them from the series.

In reply to Dr. Talbot, we had no infants on high carbohydrates, but I think the blood fat would be low under such circumstances.

The infants with acidosis fall into two classes — the undernourished and the well nourished. I have not separated them in this study, so I do not know whether one group shows higher blood fat, but I think the findings were about the same in both groups.

THE RELATIVE EFFICIENCY OF THE DIFFERENT MERCURIAL PREPARATIONS IN THE TREATMENT OF CONGENITAL SYPHILIS IN INFANTS AND CHILDREN

AS DETERMINED BY A QUANTITATIVE ANALYSIS OF THE MERCURY ELIMINATED IN THE URINE

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In spite of the different forms of arsenic used under various trade names, mercury, in some form, still holds the foremost place in the treatment of syphilis. Even when the arsenic preparations are used, mercury is usually continued for long periods in order to effect a cure.

Many of the salts of mercury, including metallic mercury itself, are administered in various ways: by mouth, by insufflation, subcutaneously and by inunction.

ABSORPTION AND ELIMINATION OF MERCURY

Owing to the difficulty in detecting mercury in the body fluids, little light has been thrown on the question as to what extent the different forms of mercury were absorbed and how eliminated. Meyer and Gottleib[1] state, "the excretion of mercury in the urine offers a means of estimating the amounts of mercury circulating in the body and the duration of its action. After absorption it circulates as a compound of mercury albuminate and sodium chlorid. It is chiefly excreted in the feces and only small amounts in the urine, and that the mercury present in the circulation probably maintains a definite ratio to the amount excreted in the urine." "The determination of the curves of elimination of mercury is of importance for the estimation of the

1. Meyer and Gottleib: Pharmacology, Clinical and Experimental. Philadelphia, J. B. Lippincott Company.

value of different methods of administration."[2] Jones[3] states, "mercury is chiefly eliminated by the urine and when it causes purgation, more is eliminated by the bowel."

Whether mercury by inunction is absorbed by the skin, has long been a cource of controversy. Up to the present year, many of the foremost authorities have claimed that no mercury was absorbed by the skin, but that the mercury was volatilized by means of the body heat and absorbed through the respiratory tract.

Wile and Elliot,[4] by employing a modification of the Reinsch method, were able to detect as small an amount of mercury as 0.025 mg. in 300 c.c. of urine. By using this method they were able to demonstrate that "the mode of absorption of mercury in the inunction cure is both by volatilization and by direct absorption through the skin." Schamberg, Kolmer, Raiziss and Gavron,[5] in an experimental study on rabbits, were able to demonstrate that "the chief avenue of absorption of mercury when applied by inunction is the skin and that rabbits may be fatally poisoned with mercury by inunction, even when no opportunity of absorption through the lungs exists."

LITERATURE ON THIS SUBJECT

So far as we have been able to determine in reviewing the literature, no work has been done on the elimination of mercury in the treatment of syphilis in infants and children.

Up to the present time, the form, dose and method of administration of mercury in the treatment of syphilis in infants and children have been more or less haphazard. Almost all of the modes are in vogue, the physician using the method which seems in his hands, to produce the best clinical results or, frequently, the one which may be given with the least suspicion as to what is being given.

Whatever form of mercury is administered, the object has been to produce a disappearance of the symptoms of syphilis and maintain the mercurial dosage in such quantities, for long periods of time, as to

2. Burgi: Arch. f. Dermatol. u. Syph., **79,** 1906.

3. Jones: Brit. Med. Jour., 1888, p. 660.

4. Wile and Elliot: Mode of Absorption of Mercury in the Inunction Treatment of Syphilis, Jour. Am. Med. Assn., 1917, **68,** 1024; Jour. Cutan. Dis., 1917, **35,** 594.

5. Schamberg, Kolmer, Raiziss and Gavron: Experimental Studies of the Mode of Absorption of Mercury When Applied by Inunction, Jour. Am. Med. Assn., 1918, **70.** 142.

keep within the tolerance as indicated by salivation and diarrhea. That mercury, even by inunction in sufficient doses, is toxic to rabbits was shown in the experiments by Schamberg and his associates.[5] In these experiments five rabbits were given from two to four inunctions of calomel ointment or mercury ointment. All of the rabbits died and showed acute hyperemia of the glomeruli and cloudy swelling of the parenchyma.

OBJECT OF THE AUTHORS' EXPERIMENTS

Our series of experiments was undertaken to determine, if possible, the extent of absorption of mercury into the circulation as indicated by the elimination in the urine, when the ordinary methods and dosage were employed and the time during which mercury continues to be eliminated in the urine after the mercury has been discontinued. The idea was to determine the frequency and size of the dose necessary to maintain mercury circulating in the body fluids, having assumed, as stated by Meyer and Gottleib, that the excretion of mercury in the urine offers a means of estimating the amount of mercury circulating in the body and that the success of the treatment depends on a certain amount of mercury in the body fluids. The effects of the various forms of mercury on the kidneys as determined by the appearance of protein, casts, or blood in the urine, was also to be estimated when possible.

Our first series of experiments were carried out according to the Elliot[6] method.

This series consisted of the following cases:

REPORT OF CASES

CASE 1.—Baby G., aged 2 weeks, was born with typical syphilitic lesions. A 1:1,000 mercuric chlorid solution was given, 10 drops, three times daily. Mercury was readily detected in the urine after the second day (not examined earlier). The mercury was discontinued and after one week the urine still contained traces. The urine, while this treatment was continued, contained appreciable amounts of protein and granular casts. The symptoms of syphilis rapidly cleared up under this treatment. Two months later, when having mercury ointment under the abdominal band, 0.5 gm. daily, appreciable amounts of mercury were found in the urine. May 17, two weeks after all treatment had been discontinued, distinct traces of mercury were found.

6. Elliot, J. A.: A New and Delicate Method for the Detection of Mercury, Jour. Am. Med. Assn., 1917, **68,** 1693.

RESULTS OF A SERIES OF EXPERIMENTS TO DETERMINE THE ELIMINATION OF MERCURY IN THE URINE

Name and Age	Diagnosis	Form of Mercury	Dose	Date of Treatment	Date of Examination	Amt. of Mercury in Mg.	Remarks
W. A. 21 months	Cerebrospinal syphilis	Gray powder and mercurial ointment	0.03 gm. 1.5 gm. every day for six days	2/22 to 3/8, inclusive	2/28	+	Appreciable amounts of protein in urine
					3/ 1	+	
					3/ 2	+	
				Gray powder discontinued, 3/8	3/ 3	+	
					3/ 7	0.44	
					3/ 8	0.97	
					3/12	+	
				Treatment discontinued, 3/26	3/26	+	
					3/28	+	
					3/29	+	
					4/ 2	+	Elimination of considerable amounts after periods during which there were only traces suggesting stored mercury in some organ
					4/ 8	1.5	
					4/ 9	0.2	
					4/10	+	
					4/12	+	
C. O. 9 years	Endocarditis; edema	Mercurial ointment	1.5 gm. 33⅓% mercury	3/19	3/19	+	
					3/20	+	
					3/21 to 4/5	—	
			1.5 gm. 33⅓% mercury	4/5	4/6	+	Note large amounts of mercury given and little elimination. Did the edema have anything to do with this lack of absorption?
			1.5 gm. 33⅓% mercury	4/6	4/7	+	
			1.5 gm. 33⅓% mercury		4/8	+	Discharged
E. B. 11 years	Congenital syphilis	.....	.....	.....	4/18 and 21	—	Had had mercury long time before
		Mercury salicylate in oil	0.5 c.c. = 0.0325 gm. mercury salicylate	4/25	4/26	0.5	
					4/27	+	
					5/ 1	+	
					5/ 2	+	
					5/ 3	+	
					5/ 4	1.0	Appreciable amounts of protein in urine
					5/ 5	+	
					5/ 6	0.35	
		Mercury salicylate in oil	0.5 c.c. or 0.0325 gm.	5/7	5/ 8	0.5	Shows accumulation in system
					5/ 9	+	
					5/10	+	
					5/12	+	
					5/16	+	
					5/21	+	
B. 5 years	Congenital syphilis	Mercuric chlorid	1:1000 solution, 10 drops three doses only	4/10	4/11	+	
					4/14	+	
					4/26	—	
		Mercury salicylate in oil	0.5 c.c. = 0.0325 gm.	4/26	4/27	+	Appreciable amounts of protein in urine. A few granular and hyaline casts
					4/28	0.4	
					4/29	+	
					4/30	+	
					5/ 1	+	
					5/ 2	0.25	

RESULTS OF A SERIES OF EXPERIMENTS TO DETERMINE THE ELIMINATION OF MERCURY IN THE URINE—(*Continued*)

Name and Age	Diagnosis	Form of Mercury	Dose	Date of Treatment	Date of Examination	Amt. of Mercury in Mg.	Remarks
D. G. 10 years	Chorea minor	Calomel	0.016 gm. four doses	5/10	5/11 5/12 5/13 5/17 5/18 5/19 5/20 5/21 5/22 5/23	+ + + + + + + + + +	Bowels loose. Probably eliminated in feces
L. 9 years	Congenital syphilis; periostitis	Mercury ointment 50	1 gm. on knee and leg daily	Daily up to 4/10, discontinued 4/27	4/11 4/27 4/28	0.54 + —	
		Mercury salicylate in oil hypodermically	0.5 c.c. or 0.0325 gm.		5/ 1 5/ 2 5/ 3 5/ 4	0.25 + + +	
C. N. 15 years	Congenital syphilis; periostitis	Mercurial ointment	1 gm. daily around knee	Daily	4/13 4/27	+ —	All treatment discontinued 4/13
		Mercury salicylate in oil	0.5 c.c. = 0.0325 gm.	4/27	4/28 4/30 5/ 1 5/ 5	+ + + +	Traces of protein in urine. Few casts
C. M. 3 years	Malnutrition	Mercury chlorid	0.5 c.c. of 1% solution hypod.	5/17	5/18 5/19 5/20 5/21 5/22-23	+ + + + +	
F. O. 5 years	Burn; scar	Mercury chlorid	0.5 c.c. of 1% solution hypod.	5/17	5/18 5/19 5/20 5/21 5/22-23	+ + + + —	
J. D. 5 years	Cystitis	Calomel	0.016 gm. for four doses	5/11	5/12 5/13 5/14 5/15 5/16 5/17 5/18 5/19 5/22	0.4 + + + + + + + +	
Boy T. 1 year	Congenital syphilis	Calomel	0.016 gm. for four doses	3/14 3/16 3/17 4/10	3/15	.. + + +	This case had had mercury inunction for considerable time, but it had been discontnued two weeks before calomel treatment
G. C. 8 years	Diabetes mellitus	Mercurial ointment	1.5 gm. 33⅓% mercury	4/4	4/ 5 4/ 6 4/ 9 4/12	1.3 + + +	

RESULTS OF A SERIES OF EXPERIMENTS TO DETERMINE THE ELIMINATION OF MERCURY IN THE URINE—(*Continued*)

Name and Age	Diagnosis	Form of Mercury	Dose	Date of Treatment	Date of Examination	Amt. of Mercury in Mg.	Remarks
J. C. 6 years	Syphilitic periostitis	Mercurial ointment	1.5 gm. 33⅓% mercury	3/12	3/13 3/14 3/15 3/16 3/18 3/19 3/20	1.0 0.10 0.12 0.10 + — —	Approximately Approximately Approximately
Boy P. 2 days	Normal; newborn	Mercury salicylate in oil	0.5 c.c. = 0.0325 gm.	5/1	5/2 5/3 5/4 5/5	1.0 + 1.0 +	No further examination
Boy J. 2 days	Congenital syphilis	Mercury salicylate in oil	0.5 c.c. — 0.0325 gm.	5/3	5/ 4 5/ 6 5/10	0.3 + +	Discharged
Boy M. 5 months	Congenital syphilis	Mercury ointment under band for past month	0.12 gm. mercury ointment	5/1 discontinued	5/ 2 5/ 9 5/16	+ 0.75 +	Treatment discontinued

CASE 2.—Baby girl R., aged 5 days, had congenital syphilis. One gram of 33⅓ per cent. mercurial ointment was rubbed into the skin. On the second day mercury was readily detected in the urine and it is probable that it could have been detected earlier if examined.

CASE 3.—Baby boy L., newborn, was given 0.03 gm. of gray powder on December 5. On December 6, 7 and 8 mercury was readily detected in the urine.

CASE 4.—Edna B., aged 25 months, had congenital syphilis. She received 0.03 gm. of gray powder December 5. December 6, mercury was readily detected in the urine, also present December 8.

CASE 5.—Baby boy P., aged 4 days, was given 0.03 gm. of gray powder for three doses on the fourth day. On the sixth and eighth days mercury appeared in the urine.

CASE 6.—Baby girl R., aged 20 months, had congenital syphilis. She received seven inunctions of 0.5 gm. of 33⅓ per cent. mercury ointment before the urine was examined. Urine contained appreciable amounts of mercury.

CASE 7.—Baby boy J., aged 11 months, had congenital syphilis. He received two inunctions of 0.5 gm. of 33⅓ per cent. mercury ointment. Following the second inunction mercury was readily detected in the urine.

Several other new-born infants were given mercury by smearing 1 gm. of 33⅓ per cent. mercury ointment on a piece of linen and placing it in contact with the skin under the abdominal band (sealed with wax paper). Owing to the small amounts of urine collected, the results in some cases were unsatisfactory, but in many, positive traces of mercury could be demonstrated. All new-born infants left the hospital on the tenth or twelfth day.

FURTHER EXPERIMENTS

The next series of analyses were made by a modification of Heinzelmann's method.[7] It was necessary on account of the difficulty of securing chemically pure zinc, to substitute aluminum for zinc and dissolve in potassium hydroxid instead of hydrochloric acid. The method is as follows:

To the twenty-four-hour specimen of urine, usually not more than 500 c.c. are used, add 1 gm. of potassium chlorate and 5 c.c. of concentrated hydrochloric acid for every 100 c.c. of urine. Heat over the free flame until the color changes from dark red to light yellow. Cool to 70 C.; add 1 gm. of very fine granulated aluminum and allow to stand over night. Decant and wash twice with about 25 c.c. of water. Dissolve in 5 c.c. of potassium hydroxid, 40 per cent.; when solution is complete add 25 c.c. of concentrated hydrochloric acid. If solution is not complete after some time heat gently, cool, pour into a Hehner cylinder and dilute to 90 c.c. with water; add 10 c.c. of saturated hydrogen sulphid water, mixing with a glass rod, which is bent into a spiral at one end. At the same time prepare a standard, using equal amounts of aluminum, potassium hydroxid, and hydrochloric acid adding with a pipet 5 or 10 c.c. of mercuric chlorid solution containing 1 or 2 mg. of mercury. Compare colorimetrically. If the day's specimen of urine is less than 100 c.c., it is diluted to 100 c.c. and carried out as above; if the amount is more than 100 c.c. and less than 500 c.c., it is used without dilution.

SUMMARY AND CONCLUSIONS

From the small series of experiments described in the foregoing charts we have drawn the following conclusions:

In infants and children, mercury, when given by the mouth, by inunction or intramuscularly, is excreted at least partly by the urine.

In new-born infants and older children mercurial ointment when placed in contact with the skin, without any friction being used (protected and sealed by wax paper from being volatilized and inhaled), is taken up by the skin and excreted in the urine and continues to be excreted in the urine for a variable time after all treatment has been discontinued.

By inunction (with rubbing) mercury is readily taken up by the skin and eliminated in the urine and continues to be eliminated for a considerable time.

When one inunction is given, the maximum daily amount of mercury is usually eliminated during the following twenty-four hours, smaller amounts being eliminated for a variable time.

7. Heinzelmann: Chem. Ztg., 1911, **35,** 724.

Where continuous inunctions are given there is an accumulation in the system and considerable amounts are eliminated at intervals with only traces between.

It is therefore probable that it is unnecessary to have mercury in contact with the skin, either with or without rubbing as often or as long as has been generally thought necessary. This, however, must be determined by further clinical investigation.

Mercury salicylate suspended in oil and given subcutaneously continues to be eliminated in the urine in appreciable amounts for eight days, or longer, the daily amounts eliminated varying widely. It is therefore probable that a repetition of the treatment, not oftener than at intervals of eight days would be sufficient.

Mercuric chlorid by intramuscular method, a favorite method in congenital syphilis, continues to be eliminated for eight days or longer.

In all cases in which mercuric chlorid was used either by mouth or the intramuscular method protein was found in the urine.

Calomel, 0.016 gm. every two hours for four doses, and gray powder, 0.03 gm. every three hours for 3 doses, continued to be eliminated in appreciable amounts in the urine for as long as nine days; the maximum daily elimination usually occurred during the twenty-four hours following administration. It is therefore probable that the daily use of any of the mercurial salts in the amounts usually prescribed, is unnecessary and presumably harmful.

We shall continue our investigations and believe it is not too much to expect that in the near future, with the methods now at our disposal of estimating quantitatively the amount of mercury in the body fluids, some degree of accuracy will be attained in the treatment of syphilis by the different mercurial preparations.

We are grateful to Dr. J. P. Sedgwick, who suggested this problem, and for his constant interest in the work.

DISCUSSION

DR. CARPENTER: I want to ask if the calomel ointment is recommended instead of the official old blue ointment, which was formerly used? The work done by Schamberg, Kolmer and Raiziss led them to believe that the calomel ointment is more readily absorbed, in which event it should be used; and in addition, it has not the disagreeable features of the ordinary blue ointment.

DR. RAMSEY: I will answer Dr. Carpenter's question by saying that we have not determined the difference in the absorption of the calomel ointment and the blue ointment, but we have determined that the calomel ointment is as readily absorbed as the blue ointment. As to the toxicity of these preparations, that has not been determined, but I hope to answer that next year.

STANDARDS FOR GROWTH AND NUTRITION*

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The widespread interest lately aroused in the prevalence and degree of malnutrition among school children makes it desirable to examine anew the facts of normal growth in this class of our population. The existence of undernourishment or malnutrition presupposes a normal standard which must be reached if a child is to be considered in perfect health.

The standards by which nutrition has been chiefly measured in the past have been the body-weight and the rate of increase in weight as compared with normal averages. Height and rate of growth in height have also been given a certain amount of value. Most observations have considered both height and weight in relation to the age of the child. The purpose of this paper is to show that the weight-to-age and height-to-age relationships are of comparatively little value in estimating the nutrition of the body. The relation of weight to height is the only one which is reliable.

The standards of nutrition which are susceptible of application to large groups of children are three:

1. The weight-to-height relationship.
2. The annual rate of increase in weight and growth in height.
3. The general appearance of the child.

In the first two of these it is easy to determine the *average;* not so easy to decide what is *normal.* Considerable variations from the average may coexist with normal nutrition. It is important to understand and appreciate how wide the individual variations may be among healthy children of the same race and living in the same environment. What deviation from the average is to be regarded as abnormal, is a question about which differences of opinion may readily exist. Any standard fixed must be an arbitrary one. To consider as undernourished any child who falls 10 per cent. or more below the normal average is a workable standard and may be adopted in practice until further experience throws more light on the subject.

Since the pioneer work of Quetelet many observations have been made both in this country and abroad on the weight, height and growth of children of the different ages of different races and environment. A special interest attaches to this subject at present, since it is the prevailing opinion that the nutrition of children in all the belligerent countries has greatly suffered because of war conditions and the rise in the cost of food.

In this article will be considered only children of the usual school ages, 5 to 16, inclusive, not because these are more important, but because more data are available than for children of the pre-school age. In the charts given we have, for similar reasons, included only those relating to boys.

During the first year of life we have been accustomed to regard the weight as the chief or sole measure of the progress in nutrition. A regular gain in weight is universally considered as the best evidence of proper growth (an exception of course being made in the case of infants fed on certain proprietary foods and others on mixtures abnormally high in carbohydrates). The growth of the infant in length has been regarded of interest chiefly for the recognition of such conditions as affect the growth of the long bones—rickets, cretinism, chondrodystrophy, etc. After the first year growth of the body in length becomes of more and more interest and of increasing importance in relation to normal nutrition and growth, but it has not received the attention which it should.

Weight and Age Variations.—By far the largest number of observations on weight published have been of weight in relation to age, and the opinion has gained currency that a child of a certain age should have a certain weight to be normal, a moderate latitude for individual variations being allowed. Since most observers give only the *average* weight of children of the different years, it is somewhat difficult from their figures to estimate for the individual variations.

In Chart 1 are given the actual net weights of boys in the Browning School[1] in New York City. It represents 1,774 observations on about 350 different boys whose weights were taken semi-annually, without clothes, over a period of years, the average number of observations on each boy being five. This group of American boys, with but few

1. I wish to express my thanks to Mr. John S. Browning, headmaster of the school, for the use of these data, and also to Dr. C. M. Williams, physical director, by whom most of the weights and measurements were taken.

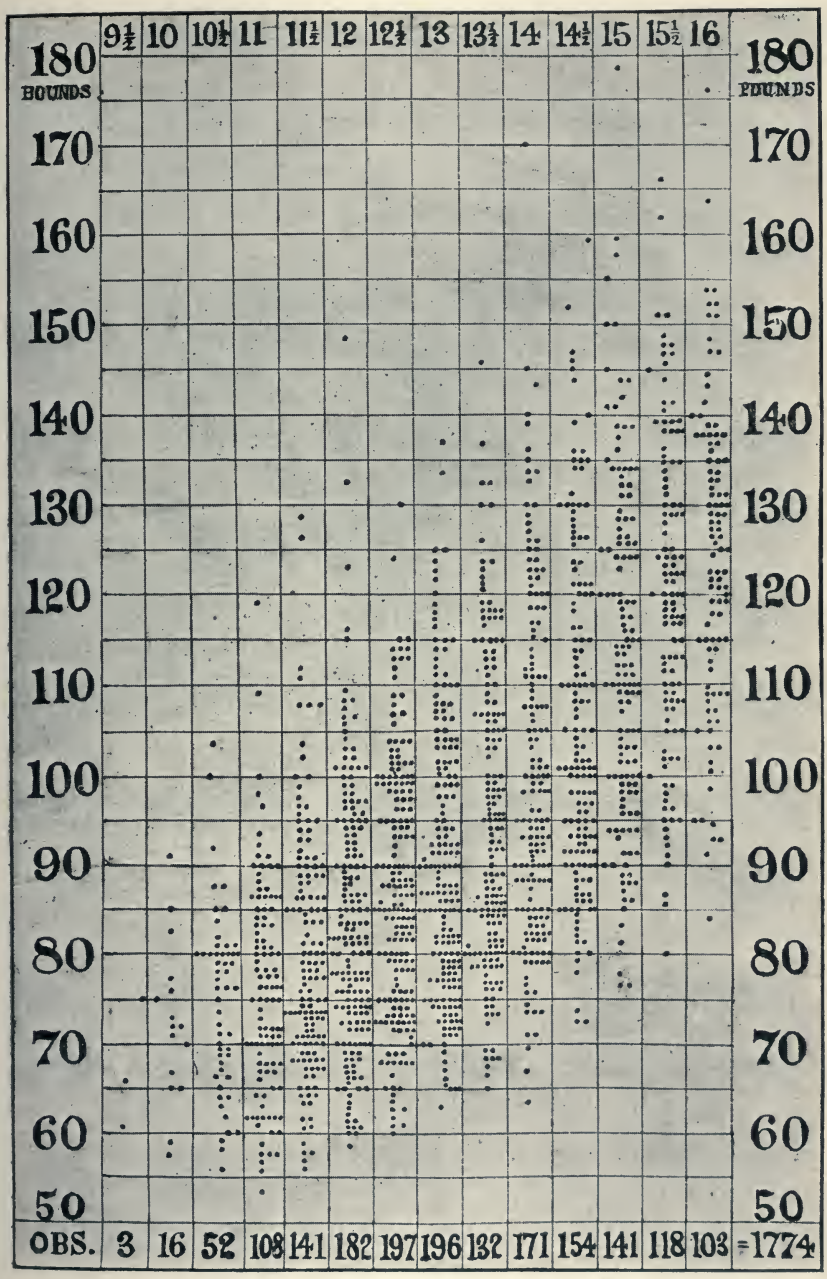

Chart 1.—Age and weight. Boys from the Browning School; 1,774 observations on 350 boys.

exceptions, came from wealthy families and had had the advantage of good care and proper food all their lives. How wide the variations are for the different ages is seen from a glance at the chart. Omitting the few very high and the few extremely low weights, we note that the individual variations for the different years are approximately as shown in Table 1.

TABLE 1.—WEIGHT-AGE INDIVIDUAL VARIATIONS (BROWNING BOYS)

At Age	Range, Pounds	Variation, Pounds	Years' Growth, Approximately
11	60- 90	30	5
12	65-105	40	5
13	70-115	45	5
14	78-125	47	4
15	90-140	50	3½

These extreme variations in healthy boys of the same social class show how hard it is to fix on a standard weight for any age. In this series slightly more than one-fourth the boys were more than 10 per cent. below the average weight of the group for the age.

It is interesting to compare these figures with those of Bowditch[2] for Boston public school boys of corresponding ages. Omitting here also the few extremely high and extremely low weights we have the results set forth in Table 2.

TABLE 2.—WEIGHT-AGE INDIVIDUAL VARIATIONS (BOWDITCH BOYS)

At Age	Range, Pounds	Variation, Pounds	Years' Growth, Approximately
5	32- 52	20	5
6	36- 56	20	4
7	40- 60	20	4
8	44- 64	20	4
9	48- 72	24	4
10	52- 76	24	4
11	56- 84	28	5
12	60- 96	36	4½
13	64-108	44	5
14	68-116	48	4
15	84-128	44	3½
16	96-142	46	3

His observations average about 350 for each year of age. Nearly one-fourth of these boys (23.2 per cent.) were 9.3 per cent. below the average weight for the age, while one-tenth of his boys were 17.2 per cent. below the average weight of the group for the age.

2. Bowditch: Growth of Children, Public Document, Massachusetts State Board of Health, 1877.

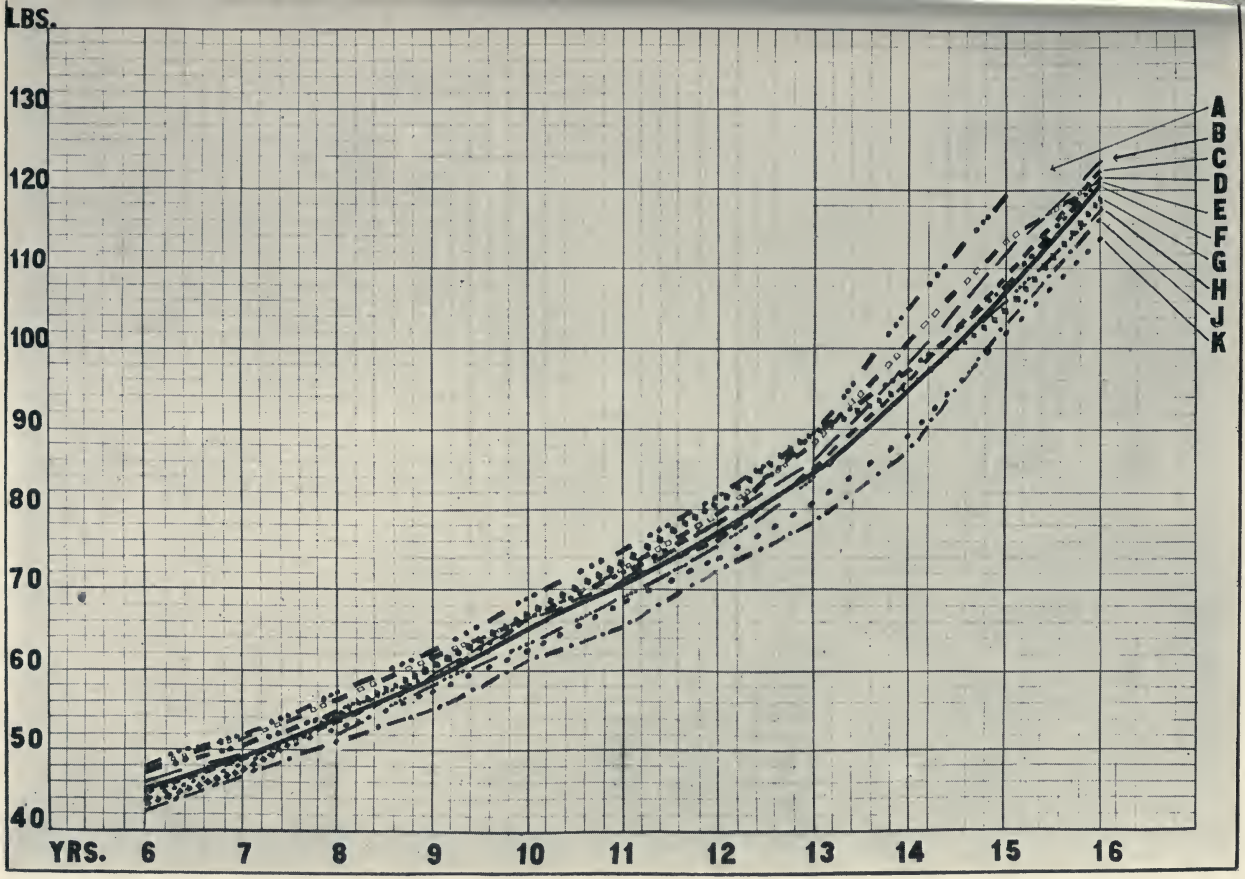

Chart 2.—Weight and age. American boys.

	Approx. No. Observations
A. Boas, California	1,900
B. West, Worcester, Mass.	1,500
C. Peckham, Milwaukee	4,000
D. Barnes, Oakland, Calif.	2,500
E. McDonald, Washington, D. C.	7,000
F. Bowditch, Boston, Mass.	13,000
G. Baldwin, Chicago and New York	100
H. Smedley, Chicago	2,500
J. Hastings, Nebraska	7,000
K. Porter, St. Louis	16,000

When we come to compare the observations[3] upon weight and age made in different parts of the United States and those made in foreign countries with the foregoing we see how wide the average weight-age variations are.

In Chart 2 are given the average weight curves of ten different series of observations on American schoolboys made in widely scattered parts of the country. These represent in all nearly 50,000 observations. The lowest average curves are "J," that of Hastings, and "K," of Porter; the highest average is "A," that of Boas. The solid black line, "F," of Bowditch, is very nearly the mean of the entire group, and may therefore perhaps be taken, as well as any single curve can, as the average curve of the country as a whole.

It will be noted that the variation in these curves, which represent averages, at 6, 7 and 8 years is only about 5 pounds; also that this variation steadily increases with the age, so that at 14 and 15 years it is about 15 pounds. There is, however, a general parallelism to the curves, indicating that the rate of gain is nearly the same in the different groups.

When Chart 2 is compared with Chart 3 it is evident what a large part nationality plays in modifying a weight-age curve. The observations in Chart 3, like the others, were made on boys in public schools. The heaviest boys for their ages are Russians and Polish (A and B). The lightest are Japanese (H); then in order come the Italian in Italy (G); Italian in the United States (K), and the German (J). Even omitting the Japanese, we see how wide is the variation in the weight-age curve among the European nations, all of which are represented in our present American population. With such wide variations as those noted both in foreign and in American boys it is evident that weight for age is not of great importance in determining the nutrition of a child.

Height and Age Variations.—The curves for height and age in a general way correspond to those of weight and age among the different groups in the United States and also among the foreign boys in their relation to each other, but the variations in the height-age curves are considerably narrower.

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3. The data from which the curves in this paper have been constructed are taken from U. S. Bureau of Education, Bulletin 10, 1914, by Bird T. Baldwin. In this will be found a very extensive bibliography on the growth of school-children.

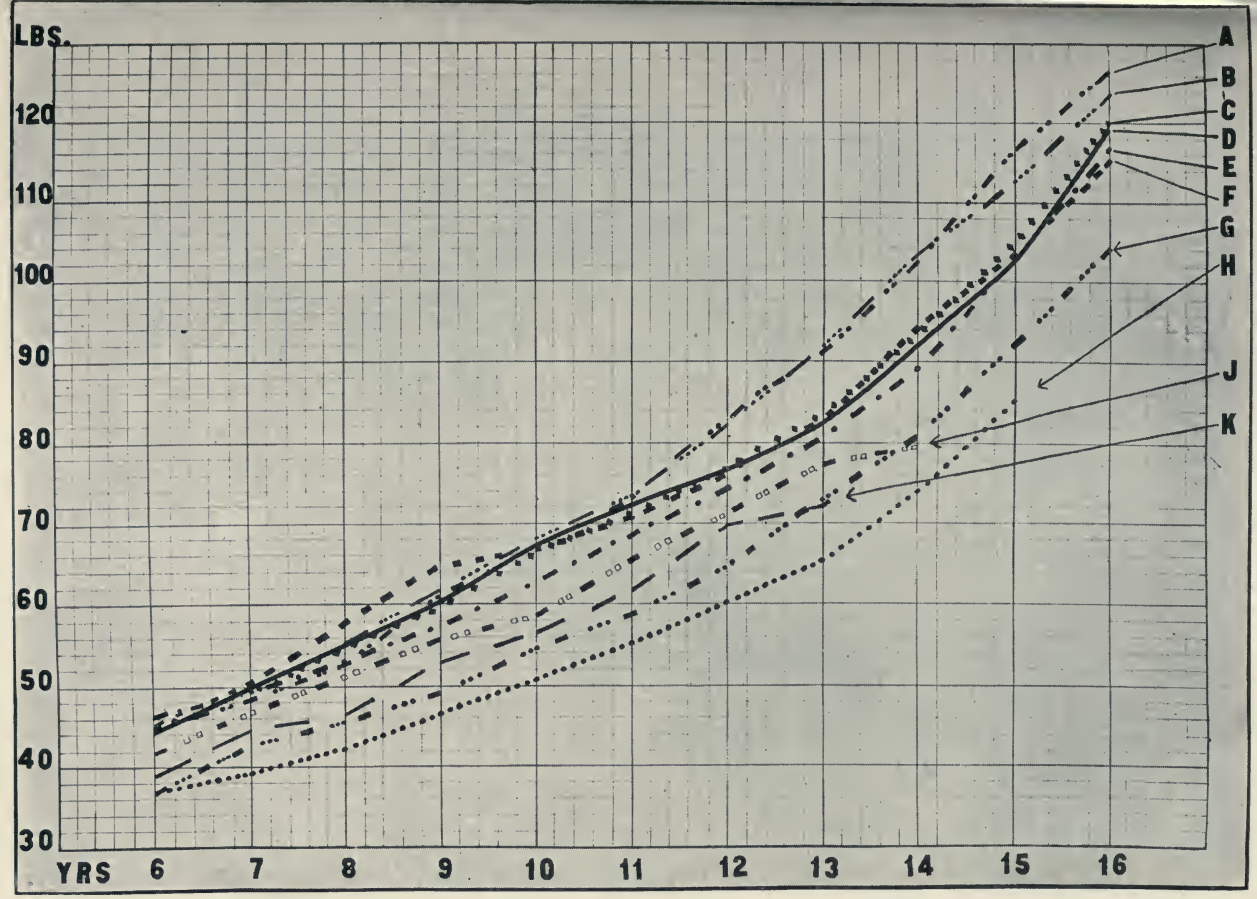

Chart 3.—Weight and age. Foreign boys.

	Approx. No. Observations
A. Erismann, Russian	2,450
B. Suligowski, Polish	1,250
C. Stevenson, British	.....
D. Roberts, British	25,000
E. Hertel, Danish	17,000
F. Key, Swedish	14,000
G. Pagliani, Italian in Italy	900
H. Misawa, Japanese	9,000
J. Schmidt, German	4,700
K. Hrdlicka, Italian in U. S.	.....

Chart 4 shows the variations in a group of boys of the same nationality and the same social environment — the boys of the Browning School. Omitting the few extremely high and extremely low measurements we note in Tables 3 and 4 the range and variation in height. Both these groups show how wide are the individual variations met with in boys of the same general class. By comparing these tables with the weight-age Tables 1 and 2, it will be seen that, estimating in years' growth, the differences in weight among individuals are less than the differences in height, and that in both weight and height as boys approach maturity these differences tend to become less.

TABLE 3.—HEIGHT-AGE INDIVIDUAL VARIATIONS (BROWNING BOYS)

At Age	Inches Range,	Inches Variation,	Approximately Years' Growth,
11	53-60	7	3
12	55-62	7	3
13	58-64	8	2½
14	59-67	9	2½
15	61-70	9	2
16	62-72	8	2

TABLE 4.—HEIGHT-AGE INDIVIDUAL VARIATIONS (BOWDITCH BOYS)

At Age	Range, Inches	Variation, Inches	Years' Growth, Approximately
5	38-44	6	3
6	40-46	6	3
7	42-49	7	2½
8	44-51	7	2½
9	46-53	7	2½
10	48-55	7	2½
11	49-57	8	2½
12	50-60	10	3
13	52-62	10	3
14	54-65	11	3
15	57-67	10	2½
16	60-70	10	2½

In Chart 5 are given the height-age curves of the American boys whose weights are given in Chart 2. It will be seen how closely these curves of average height of different groups correspond.

Only one, "A," Baldwin's, differs in any important degree from the average; "K," Porter's curve, is a little lower than the others; and "B," West's curve, a little above. The curves of the other seven observers are almost identical. The solid black line, "D," is the curve of Bowditch. This line may therefore be taken as a fair average of school boys of the United States.

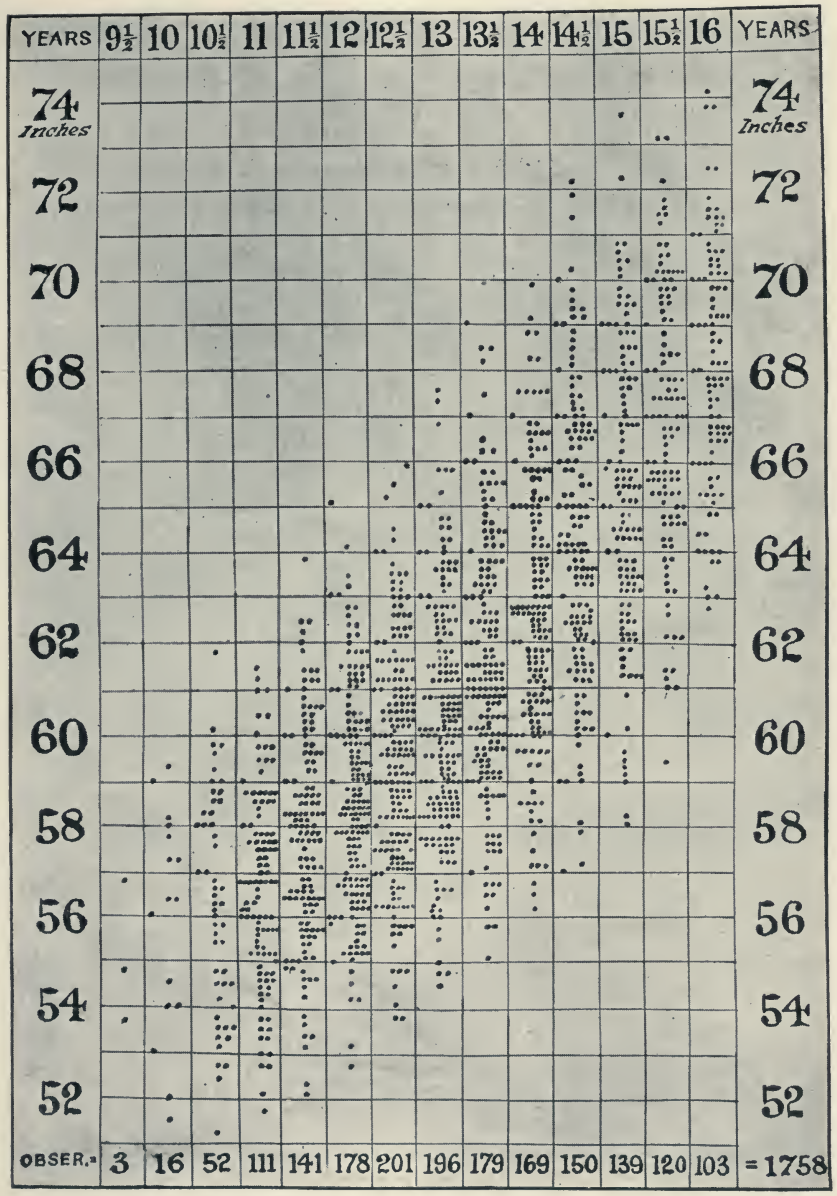

Chart 4.—Age and height. Boys from the Browning School; 1,758 observations on 350 boys.

In Chart 6 are given the curves showing average heights at the different ages of various foreign groups of boys. The variations are almost as great as are seen in the average weights of these boys, and in a general way the curves of weight and height correspond. It is clear, then, that in height as well as in weight, race must be taken into account in determining the normal average.

When very large groups are considered, the increase in height and in weight goes on together proportionately in children who are perfectly healthy. When smaller groups or individuals are closely observed it is seen that growth in height is, with the majority, more irregular than the increase in weight and is influenced by many conditions about which as yet we know very little. In private practice one is constantly impressed with the great influence of heredity as affecting growth in height. This is a factor the importance of which it is difficult to estimate when large numbers of school children are measured. The variations in height are so great that it is difficult to say how wide a deviation from the average may be considered abnormal even in the same race and social status. In the young the impulse to grow is so strong that even when food is insufficient it may continue, the increase in height taking place at the expense of the stored-up materials in the body. It may be coincident with no increase in weight or even at times with actual loss in weight. As a guide to a child's nutrition, height-age curves are therefore quite unreliable.

Weight-to-Height Variations.—A much more important relationship than weight-to-age or height-to-age as an indication of the state of the child's nutrition is that of the weight-to-height. The value of this is recognized by all the insurance companies. What an adult man or woman should weigh for his or her height is brought to our notice constantly by the figures given on the penny-in-the slot scales. In childhood less attention has been paid to this relationship than its importance deserves, and even though here there are no absolute figures of weight-to-height which can be regarded as normal, and there are considerable individual variations seen in healthy subjects, yet these variations from the average are not so great but that they furnish important information regarding the nutrition of the child.

Considering how wide is the variation seen in different races in the height and weight of boys of the same age, it is rather surprising to see how nearly alike are the curves of weight-to-height. This is shown in Chart 7, which gives the weight-to-height curves for boys

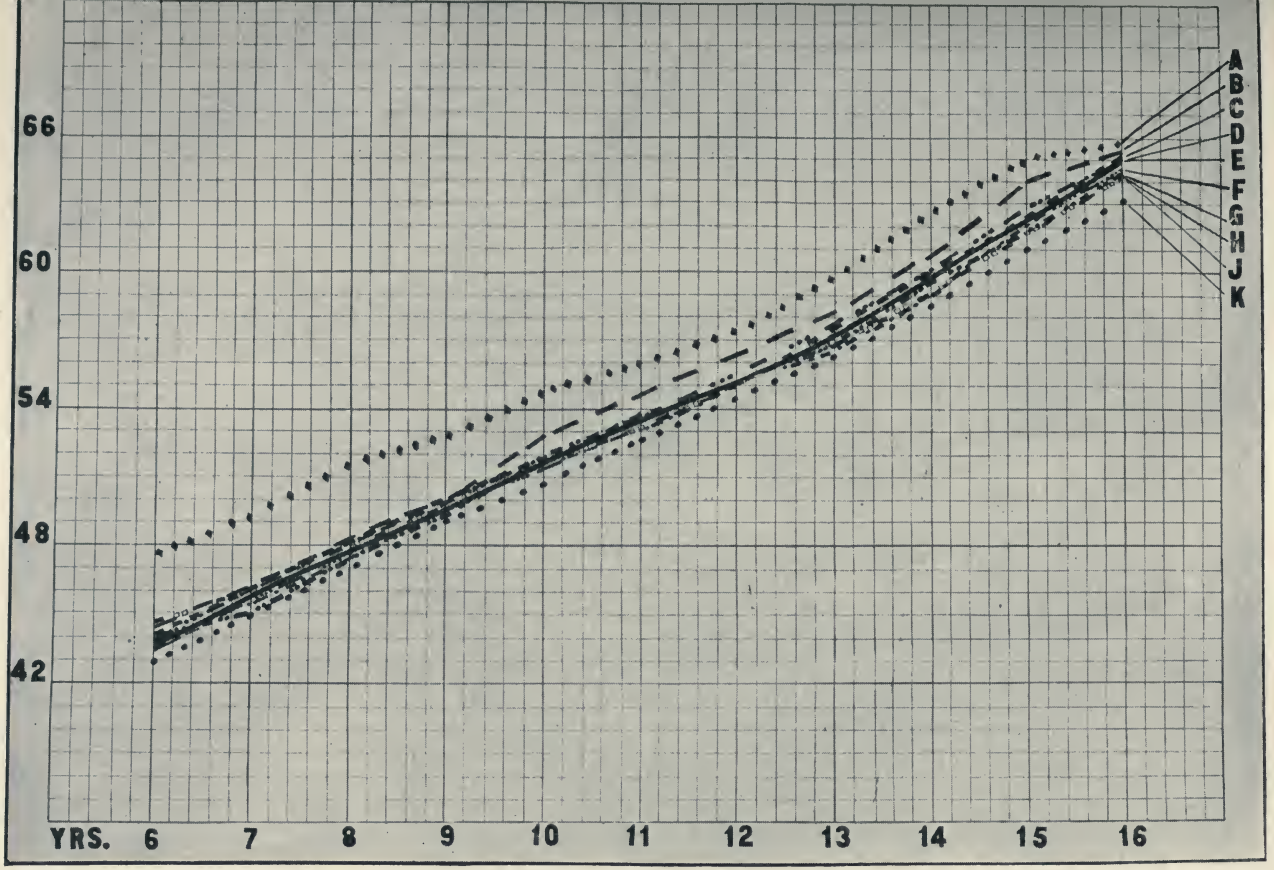

Chart 5.—Height and age. American boys.

	Approx. No. Observations
A. Baldwin, Chicago	300
B. West, Worcester, Mass.	1,500
C. Peckham, Milwaukee	4,000
D. Bowditch, Boston	13,000
E. Boas, California	44,000
F. Smedley, Chicago	2,500
G. Barnes, Oakland, Calif.	2,500
H. Hastings, Nebraska	7,000
J. McDonald, Washington, D. C.	7,000
K. Porter, St. Louis	15,000

from five different nationalities; the two tall and heaviest (Russian and Polish), the two small and lightest (Italian and Japanese) and the American, using Bowditch's figures for Boston school boys of American parentage.

That these curves are so nearly alike indicates how independent of nationality is this index of nutrition. Thus, the average Japanese boy of 50, 60 and 80 pounds is only one inch shorter than the average American boy of the same weight; while those of 70 pounds weight appear exactly the same height. So, also, the Italian boy, who, though much shorter than the American for his age (Chart 5), is for his weight only from half an inch to an inch shorter than the American up to a weight of 105 pounds and a height of 62 inches; the only exception to this being the short period when the weight is in the neighborhood of 50 pounds and the height near 50 inches. The chief difference between the tall and short races is that in the latter growth is slower and ceases at an earlier period.

Weight-Height Index.—The determination of where a child stands in the relation of his height to his weight is undoubtedly the best simple guide in fixing his status as to his nutrition. This ratio expresses the general solidity or robustness of the body and is therefore significant. The weight in kilos divided by the height in centimeters, or weight in pounds divided by height in inches gives what is sometimes called the *weight-height coefficient* or *weight-height index* of the individual. This weight-height index increases steadily and quite uniformly from 5½ up to 18 years. According to the observations of Baldwin, the lowest weight-height index in boys is at 6 years, when it is 0.15; the highest is at 17½, when it is 0.40.

The same thing is shown in another way in Table 5, the data for which are taken from Bowditch. Here is given the increase in weight which corresponds to each inch increase in height.

In all observations on weight and height of children the *average* is not to be confused with or regarded as the *normal.* There are considerable variations on either side of the average which should be regarded as within the range of the normal. The normal is a zone, not a line. How far below the average weight for his height a child should be for his nutrition to be considered below the normal, one cannot say absolutely. If we regard all those who are 10 per cent. or more below the average line as undernourished or as examples of malnutrition, we shall not go far wrong. For practical purposes we may assume this to be correct.

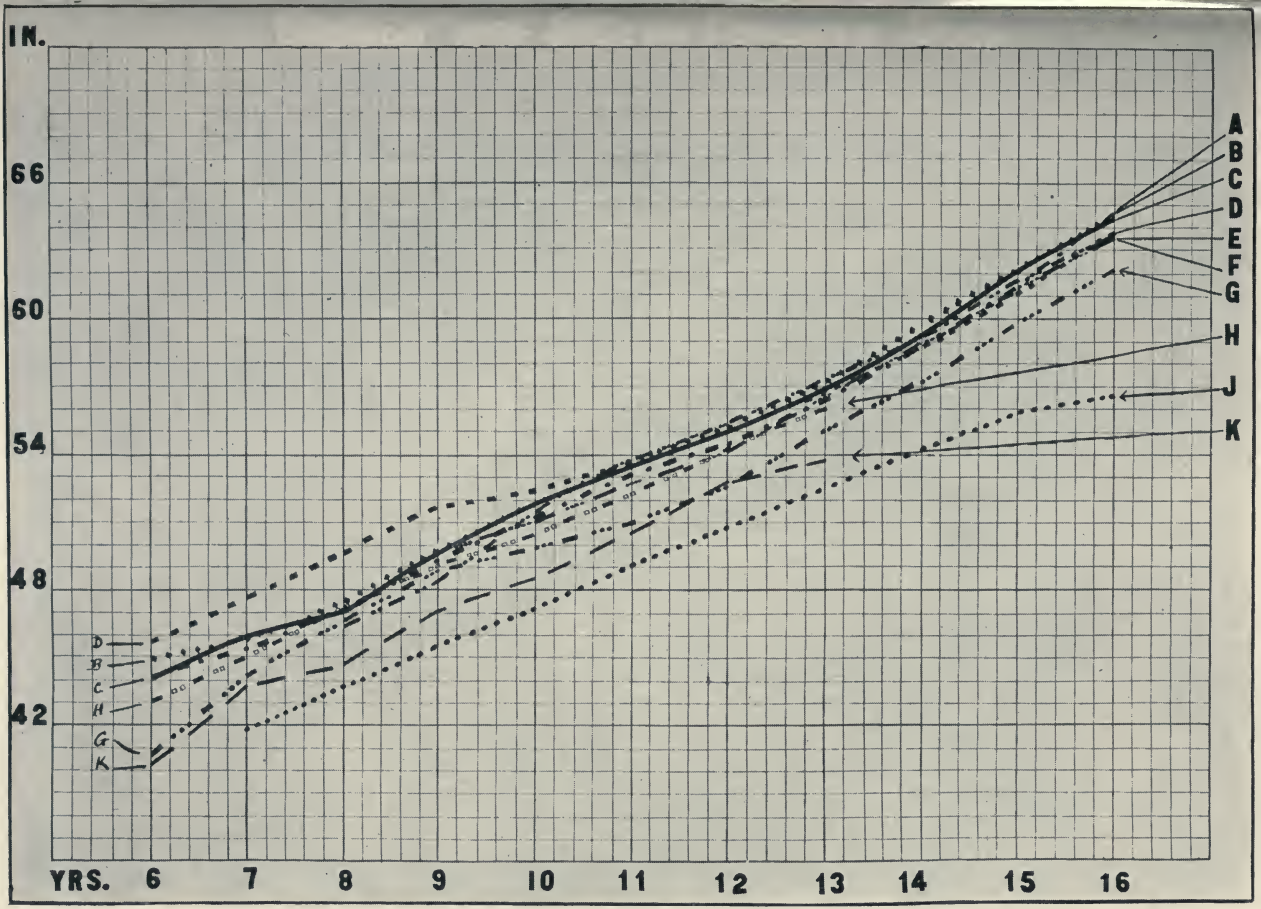

Chart 6.—Height and age. Foreign boys.

	Approx. No. Observations
A. Hertel, Danish	17,000
B. Stevenson, British	.....
C. Roberts, British	25,000
D. Key, Swedish	14,000
E. Erismann, Russian	3,000
F. Suligowski, Polish	1,000
G. Pagliani, Italian in Italy	900
H. Schmidt, German	4,700
J. Misawa, Japanese	9,000
K. Hrdlicka, Italian in U. S.	....

TABLE 5.—WEIGHT-TO-HEIGHT INCREASE

Boys				Girls		
Height, Inches	Weight, Pounds	Increase Per Inch, Pounds	Approx. Age, Years	Weight, Pounds	Increase Per Inch, Pounds	Approx. Age, Years
42	41.8	...	5	40.9	...	5
43	43.6	1.8	..	42.6	1.7	..
44	45.6	2.0	..	44.5	1.9	..
45	47.6	2.0	6	46.5	2.0	6
46	49.6	2.0	..	48.5	2.0	..
47	52.1	2.5	7	50.7	2.2	7
48	54.6	2.5	..	53.2	2.5	..
49	57.3	2.7	9	56.1	2.9	9
50	60.2	2.9	..	58.8	2.7	..
51	63.2	3.0	10	61.4	2.6	10
52	66.3	3.1	..	64.4	3.0	..
53	69.2	2.9	11	67.5	3.1	11
54	72.7	3.5	..	71.0	3.5	..
55	76.4	3.7	..	74.9	3.9	..
56	80.2	3.8	12	78.8	3.9	12
57	84.0	3.8	..	83.4	4.6	..
58	87.9	3.9	13	87.9	4.5	..
59	91.6	3.7	..	93.3	5.4	13
60	95.5	3.9	..	98.8	5.5	..
61	100.5	5.0	14	105.4	6.6	..
62	105.6	5.1	..	115.7	10.3	14
63	110.7	5.1	15	.....	....	..
64	115.9	5.2	..	.....	....	..
65	121.0	5.1	16	.....	....	..
66	126.6	5.6	..	.....	....	..
67	136.1	9.5	..	.....	....	..

Annual Rate of Increase in Weight and Height.—The weight to height relation we have concluded to be the best general starting point or base line for observations on the nutrition of children;[4] but nothing indicates their progress so well as the annual increase in height and weight. Like an infant, a boy or girl to be healthy must grow; and a record of such growth of any child extending over a period of years will be found to be an accurate and trustworthy record of his general health during that period.

The annual rate of gain of healthy school boys of corresponding ages is nearly the same in different parts of the United States and in foreign countries. In the accompanying table (6) is given the average annual gain in weight and height of American boys and girls, calculated from the data represented in the curves previously given. It will

4. There are some exceptions to this rule. Certain children, not a large group, may be stunted in growth by conditions which also affect weight, so that the relation of weight to height is average, though the child is much below the normal in both.

be noted that in the boys the gain in weight increases with each year of age after 7 years, except between 10 and 11, when it is less than for the preceding period. This slowing up in growth before the marked increase of approaching puberty is noted in nearly all the different groups of boys observed.

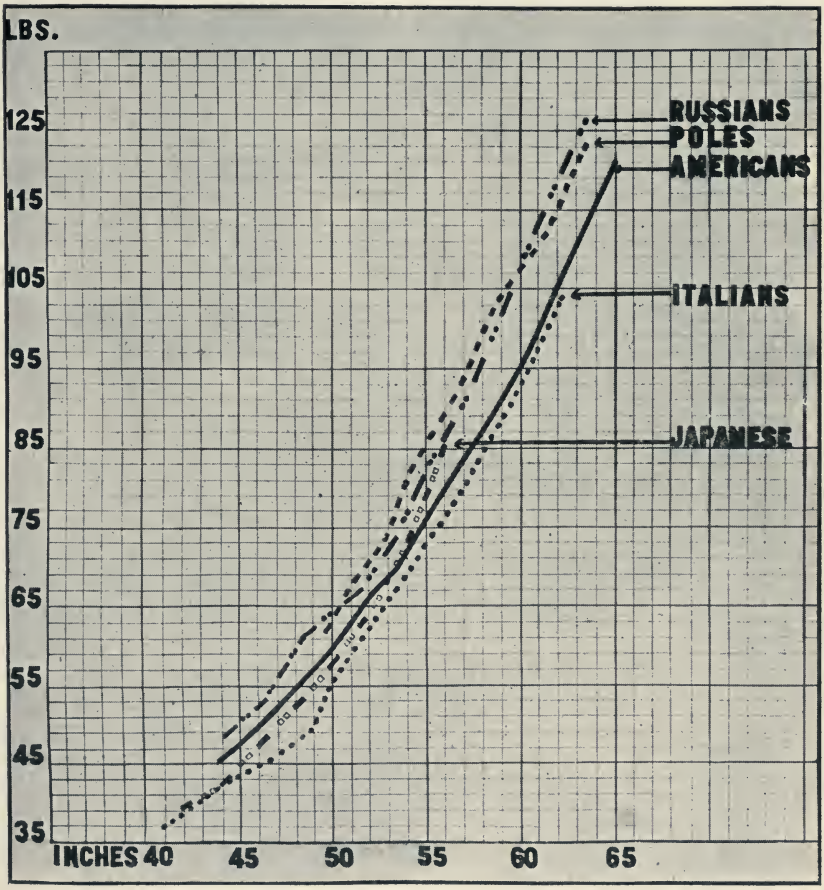

Chart 7.—Weight and height.

The yearly increment in height is less between the tenth and twelfth years than before or after this period. Like the increase in weight, it is least between 10 and 11 years. It does not show a marked increase until after 12, when the rapid growth of puberty begins. This is about a year later than the more rapid increase in weight.

As children grow older the increase in height and weight is less uniform and regular. There are seen with nearly all healthy children periods, often of several months' duration, in which growth and gain in weight are rapid, followed by periods in which both are much slower. This may occur where no special cause can be discovered. It is often seen as puberty approaches.

TABLE 6.—AVERAGE ANNUAL INCREASE IN WEIGHT AND HEIGHT AT THE DIFFERENT AGES

BOYS

	Weight		Height	
Age, Years	Range, Pounds	Average, Pounds	Range, Inches	Average, Inches
6- 7	3 - 5	4	1.5-2.5	2
7- 8	3.5- 5	4.75	1.5-2.5	2
8- 9	4 - 6	5.25	1.5-2.5	2
9-10	4 - 7	6	1.5-2.5	2
10-11	4 - 6.5	5	1.4-2.0	1.7
11-12	4.5- 7.5	6.5	1.3-2.0	1.8
12-13	6 - 9	8	1.5-2.5	2
13-14	8 -12	10	2 -3	2.5
14-15	10 -15	12.5	2 -3.5	2.7
15-16	9 -15	13.75	2 -3.5	2.7
16-17	4 -12	6.5	0.5-2	1.2
17-18	4 - 8	5	0 -1	0.5

GIRLS

	Weight		Height	
Age, Years	Range, Pounds	Average, Pounds	Range, Inches	Average, Inches
6- 7	3 - 5	4	1.5-2.5	2
7- 8	2 - 5	4.5	1.5-2.5	2
8- 9	3.5- 6	5	1.3-2.4	1.75
9-10	4 - 6	5.25	1.5-2.5	2.25
10-11	4.5- 7	6.5	1.5-2.5	2
11-12	7 -11	9.5	2 -3	2.5
12-13	8 -12	10.5	2 -3	2
13-14	7 -11	9.5	1.3-2.4	2
14-15	5 -10	7.5	1 -2	1.25
15-16	3 - 8	6	0 -1	0.75
16-17	2 - 6	3.5	0 -0.5	0.50
17-18	0 - 2	0.5	0 -0.2	0.2

Children who are much below normal weight usually gain rapidly when the cause for the low weight can be discovered and removed.

Seasonal Growth.—The question is often discussed during what season of the year the most rapid growth in height and increase in

weight occur. The observations made on the Browning boys are of interest as throwing some light on this point. Of 703 observations made on weight for the six months from November to May and from May to November, the average gain for the summer six months was 1¼ pounds greater than for the same boys during the winter six months. The same thing was seen in growth in height. Of 544 observations made on height, the average increase was 0.36 inch greater for the summer six months than for the same boys during the winter six months. These facts confirm the general law that in healthy individuals increase in weight and growth in height go on together and approximately at the same rate.

The explanation for more rapid growth during the summer season would seem to be that this period includes the school boy's vacation time, during which he leads a more free and more outdoor life; while the winter period includes most of the colds and other respiratory diseases and a large part of the contagious diseases from which those of these ages are likely to suffer, all of which arrest growth and gain in weight.

General Appearance.—In estimating a child's condition as to his nutrition, careful inspection may tell a good deal, particularly to an experienced observer. The color of lips and cheeks and the facial expression are significant of anemia, fatigue or even exhaustion. If the clothing is removed to the waist, the muscular development and the amount of subcutaneous fat can be determined as well as a narrow chest and round shoulders recognized. Such an inspection taken in connection with height and weight enables the examiner to form a pretty accurate estimate of the child's nutrition.

The so-called Dunfermline scale in which children are graded in their nutrition by their appearance as I, good; II, fair; III, below average; IV, very bad, is not a very trustworthy way of estimating the nutrition if such inspection is made without undressing the child at all and without taking account of height and weight. But taken in conjunction with height and weight and when made by a person of experience, the general appearance is of great assistance in grading the child, and the grouping in the above scale is very convenient for practical purposes.

14 West Fifty-Fifth Street.

DISCUSSION

DR. LA FÉTRA: Dr. Holt's charts are very interesting, especially so since we have thought we had a definite standard of growth for boys between 12 and 15 years.

DR. TALBOT: I am very much interested in these figures, especially as we have need of them in the work we are doing in the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Mass., at the present time. In doing our work on the metabolism of children we have found such a divergence in the basal metabolism of children as there is in the measurements reported by Dr. Holt. We do not know where to turn to find the normal measurements, and we first have to find out what is normal and come to some conclusion as to the normal relations between height and weight. There is quite a variation between height and weight in children who are to all intents and purposes normal. In the new-born we have been able to establish a ratio between the metabolism and the body weight. By using the Lissauer formula the metabolism can be estimated, and it comes within 6 per cent. of the measured metabolism. These figures which Dr. Holt has presented are very important.

DR. PISEK: We have needed just such a standard as this one that Dr. Holt has given us. Many observations have been made in infancy and in children of school age, but there is a gap between the ages of 2 and 6 years. Many of the observations in reference to weight and height that have been made are unreliable, but if they are made by members of this society or under their supervision, we will then get figures that we can rely on.

DR. MORSE: Some observations with referennce to the rapidity of growth at different seasons of the year show that growth in height is most rapid in the spring and gain in weight is most rapid in the autumn, and not synchronous, as Dr. Holt has found in this series of observations.

DR. GRIFFITH: A little over a year ago I became interested in the growth and gain in weight of children during the neglected period, that is, between the age of 2 and 6 years, and published a paper on the subject, based on observations on 200 children. There is only one item that I wish to mention here. Practically all published weighings of children in the first two years of life are of them undressed; while those of 5 years and older include the weight of the clothes. There are very few observations of any sort on children from 2 to 5 years of age. This difference in the matter of the clothing makes a necessary break in the weight curve from birth to puberty which must always be taken into consideration. My own weighings for the first 5 years of life were made of the children clothed and then nude; the effect being to determine what could be called the average absolute weight of the clothing at this period. We have full information from Bowditch's figures what this may be assumed to be after the age of 5 years. I found that the average weight of the clothes in the first 2 years equalled 1¾ pounds, and from this to 5 years, from 2 to 2½ pounds. The practical importance of these observations depends on the fact that we are very commonly obliged in private practice in children in the first 5 years of life to weigh the subjects dressed, on account of the inconvenience attending any other procedure; and that we should be able under these circumstances to estimate readily what the nude weight of the subject may be.

DR. HESS: During the past six or seven years we have been following the weights of children at the Tuberculosis Preventorium that are not tuberculous but merely undernourished. It has been our experience that they do

not gain well in the summer months, June, July and August. The reason Dr. Holt has found a greater gain during the summer may be because the boys were housed up in school during the winter and led quite a different life in the summer. The fact that these boys were out of doors and led a freer life may account for the greater gain in weight at this time. It is also to be noted that there is a difference between boys and girls as to gain between the ages of 6 and 10 years. At this age the girls gain more rapidly than the boys. I would like to ask Dr. Holt whether the curves represent only boys or whether there were also girls included in the study. I think to make figures of practical value the observations should be made on hundreds of thousands of children.

DR. DEBUYS: I would like to ask Dr. Holt over a period of how many years were these statistics collected to which he referred in his paper? Might not the variations in heights and weight in the more recent statistics be the result of propaganda of an educational character which has been carried on for the past several years?

DR. PISEK: Anthropologists have agreed to throw out all gross variations. Hrdlicka of the Smithsonian Institute has thrown out all the gross variations in plotting curves, and this is a point that deserves to be taken into consideration.

DR. HOLT: The first point to be emphasized is that a normal curve is not a line but a zone, and a much wider zone than we have appreciated; that is what the curves of the Browning School show. Bowditch made his observations over forty years ago; the observations on Browning School boys were made on the children of the present generation, and it is the general belief that the children of the present generation are taller than those of the previous generation.

As to the growth and weight of girls as compared with boys: up to the age of 10 years the boys are about 1 pound heavier; then the girls begin to gain more rapidly and pass the boys during the eleventh year. They continue to be ahead until about the age of 15 years, then the boys pass the girls again.

Dr. Griffith has spoken of the weight of clothes. Bowditch has shown that the weight of the clothes in young boys and girls averaged very nearly the same. In the older groups the boys' clothing is heavier. There is not a very wide variation in the weight of the clothing of boys or girls of the same age.

As to the question whether growth is more rapid in the winter than in summer, the data obtained from the Browning School are of interest. The greater gain in the six months which include summer vacation is probably due to more out-of-door life, opportunities for exercise and freedom from illness during this period. In studying the records of the individual boys it is clear that gain in height and weight is usually in parallel lines unless there has been illness.

The Dunfermline scale should perhaps be mentioned, though I can only mention it to express my belief in its unreliability. It has been widely used by the New York Health Department to determine the nutritional condition of schoolchildren. It divides the children on appearance into four classes: good, fair, poor and very poor. Weight and height are not considered. Dr. Charles Hendee Smith tells me that recently of eight children who were picked out as undernourished and sent to his malnutrition class, seven were over weight.

DR. CHARLES HENDEE SMITH: The problem of standards for judging nutrition has interested us greatly at Bellevue. When we started the nutrition class we found that there were no satisfactory standards for weight and height.

Those used by the Health Department are the standards of Bowditch, which were compiled from children in New England several years ago. The figures of Boas run several pounds below those of Bowditch. In order to determine which were nearer the average for the East Side children of New York, we plotted a large number of the children coming to the Bellevue Out-Patient Department, and found that the line representing the figures of Boas gives a very good average. The curves plotted by Dr. Holt, showing the averages given by different authorities, are apparently very near together, but a careful inspection shows that there are from 12 to 14 pounds difference between these average lines at about the age of puberty.

It seems to me that a zone rather than a line should be drawn, which would include the high and low averages much better than a single line.

There is no question but that undernutrition effects growth in height as well as weight. Certain children are stunted in growth by the same causes that keep them underweight, and these children can be made to grow more rapidly and make up their deficit by proper feeding and hygiene. Heredity, of course, has a great influence. We do not expect the children of short parents to be as tall as those of tall parents, but I think we will all agree that with good care the children of short people are commonly taller and better nourished than their fathers and mothers.

THE COMPLEMENT FIXATION TEST FOR TUBERCULOSIS IN INFANCY AND CHILDHOOD

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There has been a very marked diversity of opinion with regard to the value of the complement fixation reaction for the diagnosis of tuberculosis. Since 1903, when Bordet and Gengou[1] reported the presence of antibodies in the blood of animals afflicted with this disease, numerous workers have attempted to perfect a method for their accurate determination in man.

Among the earlier studies the most notable were those of Wassermann and Bruck,[2] and later of Citron.[3] Their work was thorough and along modern principles. Their results, however, were very irregular and uncertain. It may be of interest to know that it was these experiments on complement fixation for tuberculosis that led to the discovery of the Wassermann reaction.

During the next decade the researches of many laboratories were very discouraging. The reports vary tremendously. In 1911 Caulfield and Beatty,[4] in the *Journal of Medical Research,* record 70 per cent. and 62 per cent. positive reactions in stages two and three of the disease, respectively. No fixations were obtained in normal cases. The following year the same publication contains a report by Laird,[5] noting only four positive reactions among thirty-four tuberculous patients. Dielman[6] and Much[7] found positive fixations in clinically nontuberculous cases and in perfectly healthy individuals.

During the past few years the results have been almost uniformly much more favorable. Encouraged by the work of Besredka,[8] inten-

1. Bordet and Gengou: Compt. rend. Soc. de biol. **127**: 1903.
2. Wassermann and Bruck: Deutsch. med. Wchnschr. **32**: 1906.
3. Citron: Berl. klin. Wchnschr., 1907, p. 1135.
4. Caulfield and Beatty: Jour. Med. Research **24**:122, 1911.
5. Laird: Jour. Med. Research **27**:163, 1912.
6. Dielman: Ztschr. f. Immunitätsforsch. **10**:421.
7. Much: München. med. Wchnschr., 1912.
8. Besredka: Ztschr. f. Immunitätsforsch., 1914.

sive studies were made by Inman,[9] Debains and Jupille,[10] Bronfenbrenner,[11] McIntosh and Fildes,[12] Radcliffe,[13] and Petroff.[14] Very recently the best results have been published by Craig,[15] Miller and Zinsser[16] and H. von Wedel[17] of the New York Health Department laboratory. Miller obtained 275 positive reactions among 284 tuberculous pulmonary cases. Nontuberculous and normal individuals reacted negatively. Five cases of tuberculous bone and joint disease gave positive reactions. Of four cases with proved tuberculous meningitis, positive fixations were present in three.

Craig's results have been equally favorable. Of 209 cases of tuberculosis, 87 per cent. reacted positively, 96 per cent. in the active stage and 65 per cent. in the inactive stage. The latest figures on the subject are those presented by H. von Wedel at a recent meeting of the New York Academy of Medicine. He obtains 98 per cent. positive reactions among active tuberculous cases.

The technic of the test is essentially the same as that of the Wassermann reaction. The important problem has been the development of a suitable antigen. All the antigens used have been grouped by Miller[18] into four general classes:

1. Antigens composed of whole tubercle bacilli in suspension and after treatment with cold, heat, etc.

2. Tuberculins of all kinds have been used as antigens, notably by Besredka and Petroff.

3. Extracts of tubercle bacilli obtained by subjecting the bacteria to various processes of digestion and extraction.

4. Antigens produced from tuberculous and normal tissue. These latter have been employed by very few workers. Good results were

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9. Inman: Compt. rend. Soc. de biol., 1914.
10. Debains and Jupille: Compt. rend. Soc. de biol., 1914.
11. Bronfenbrenner: Ztschr. f. Immunitätsforsch., 1914.
12. McIntosh and Fildes: Lancet, London, 1914.
13. Radcliffe: Jour. Hyg., 1915.
14. Petroff:
15. Craig: Jour. Am. Med. Assn., March 10, 1917, p. 773.
16. Miller and Zinsser: Tr. New York Path. Soc., Feb. 7, 1916, referred to by Miller in Jour. Am. Med. Assn. **67**:1519, 1916.
17. H. von Wedel: Read at Meeting of New York Academy of Medicine, May 2, 1918.
18. Miller: Journal of Laboratory and Clinical Medicine **1**: No. 2.

obtained by Hammer[19] with this antigen. He reports forty-three positive reactions among forty-six tuberculous patients.

Being impressed by the many recent favorable results obtained on general groups of individuals, we thought it might be worth while to determine the value of the fixation reaction for the diagnosis of tuberculosis among infants and children. Very little work indeed has been done with special reference to the young. We have not been able to find any reports by English or American authors. Schlossman[20] and Bauer and Engel[21] were able to obtain positive reactions only in highly immunized children. Fua and Koch[22] reported negative reactions among twenty-seven tuberculous cases, including six of tuberculous meningitis, three of pulmonary tuberculosis, five of tuberculous bone conditions and one of tuberculosis of the pleura. Of forty-one cases treated with tuberculin, fourteen reacted positively. Bauer[23] found fifteen positive reactions among twenty-one children injected with tuberculin.

Esther Rosencrantz[24] tested 100 serums of the new-born obtained after section of the cord, and before expulsion of the placenta. The mothers were tuberculous. In all there were 14 positive reactions, 78 negative and 8 doubtful. She used an antigen produced by prolonged maceration of tubercle bacilli over a water-bath.

Our own cases were taken from the pediatric service of Dr. Koplik at Mt. Sinai Hospital, and the tests were performed at the hospital pathological laboratory by Dr. D. Kaliski, in charge of the serological department.

The half Wassermann system was employed for all tests. Two antigens, those of Miller and Petroff, were employed. The former was made in the laboratory by taking 20 mg. of a number of strains of dried tubercle bacilli, grinding intimately with 90 mg. of table salt, and then adding distilled water up to isotonicity. It is then titrated in the usual manner. The second antigen, kindly prepared by Petroff for the laboratory, consists of a filtrate of cultures on potato-broth and

19. Hammer: Deutsch. Tierarzt. Wchnschr., 1912.

20. Schlossman: Deutsch. Med. Wchnschr., 1917.

21. Bauer and Engel: Quoted by Fua and Koch, Beitr. z. klin. Tuberk., Wurzburg, 1909.

22. Fua and Koch: See Footnote 21.

23. Bauer: Komplementablenkung der Tuberculosen Kindern, München. med. Wchnschr., 1908.

24. Esther Rosencrantz: Compt. rend. Soc. de biol., 1911.

a glycerin extract. The serums from 50 patients ranging from 6 months to 12 years were tested: 16 cases were tuberculous, 6 were considered probable or suspicious, and 28 were nontuberculous. Among the former groups we included 6 cases of tuberculous meningitis, 7 of pleural effusion, 6 pulmonary, one peritonitis, one adenitis, and one tabes mesenterica.

Our 6 cases of tuberculous meningitis ranged in age from 1 to 12 years. They all presented the clinical picture of the disease. There was nothing unusual in their course, all terminating in death. In 4 instances tubercle bacilli were found in the cerebrospinal fluid. Complement fixation reactions on the blood of these patients with both antigens were negative in 4, only suspicious in 2 cases. It may be said that the lowered vitality fails to stimulate the production of antibodies; thus no inhibition takes place. But whatever the explanation may be, for the diagnosis of the condition we have found the test of no value.

Of 7 cases of pleural effusion, 1 case was definitely tuberculous, 3 were probably tuberculous, and 3 others were cases in which the etiology could not be clearly determined. In the first case tubercle bacilli were found in the pleural fluid obtained by aspiration. Complement fixation tests on the blood of this patient were negative with Miller's antigen and 4 plus with Petroff's. In a second case we had a family history of tuberculosis and marked enlargement of bronchial lymph nodes as demonstrated by the roentgen ray. Two other cases of probable tuberculous infection the patients had a history of cough of long duration, periods of remittent temperature, positive von Pirquet reaction and roentgen-ray findings suggestive of pulmonary infiltration. In these cases complement fixation tests were negative with both antigens. The serum of the three patients in whom the etiology was not clinically determined gave negative reactions also.

Of six children with pulmonary involvement two were cases of miliary tuberculosis with the usual course. Roentgen-ray findings were very typical of the disease. In another case, a boy of 12, with physical signs and roentgen-ray findings pointing to involvement of right upper lobe, tubercle bacilli were demonstrated in the sputum. Two other cases showed only slight signs, but with definite roentgen-ray shadows of infiltration. Fixation reactions were all negative with both antigens in these cases. The sixth case had marked bronchial gland involvement, with signs of diffuse chronic bronchitis, and a

history of persistent cough; no organisms were found in the sputum. Fixation in this case was 2 plus with Petroff's antigen and negative with Miller's.

One case of tuberculous peritonitis gave a negative reaction with both antigens. The diagnosis was subsequently confirmed by findings at the operating table.

The case of cervical tuberculous adenitis had a chronic mastoid sinus with little tendency to heal; von Pirquet strongly positive; complement fixation negative.

In a case of tabes mesenterica, von Pirquet positive, the serum gave an absolutely negative reaction with both types of antigens.

Among 28 cases, with no symptoms or signs of tuberculous infection, complement fixation tests revealed 3 strongly positive reactions, 1 faint inhibition, 1 suspicious reaction. One was a boy of 12 years with a definite rheumatic pericarditis, lungs clear, von Pirquet negative. A second was in an infant of 9 months with signs of an acute bronchopneumonia. It recovered completely; von Pirquet negative. In both these cases the serums showed a 4 plus reaction.

The third case was one of endo-pericarditis. Here the roentgen ray showed a faint lung shadow only suggestive of infiltration, but there were no physical signs, and the von Pirquet test was negative. The cases with suspicious and slight inhibition reactions were an acute pneumonia and an acute endocarditis.

CONCLUSIONS

Complement fixation tests for tuberculosis on the serums of seventeen tuberculous infants and children with Miller's and Petroff's antigen gave one 4 plus, one 2 plus and two suspicious reactions.

Complement fixation test, on the serums of five children, probably, but not definitely, tuberculous were all negative with both antigens.

Complement fixation tests on twenty-eight nontuberculous infants and children gave three 4 plus and two suspicious reactions.

In view of the very favorable results reported by other men with the same antigens in general groups of individuals, before discarding the test for children we should like to learn the experience of others in this field.

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DISCUSSION

DR. ARMAND-DELILLE: Some years ago I made complement-fixation tests in tuberculous children and also in adults. I used, first, the old tuberculin and afterwards the antigens of Calmette and Petroff, and I can sum up my results very briefly. I found exactly what Dr. Heiman has found. I found that in differentiating the tuberculous from the nontuberculous the complement fixation test was of no value. In fact, there were more positive results in healthy children than in children sick with tuberculosis.

DR. SEDGWICK: The result with the complement fixation test in tuberculosis is largely dependent on the antigen. Dr. Larson of the University of Minnesota has devised a better antigen than those that are being used. He puts the bacilli under high pressure, which he then releases suddenly, and each individual organism is exploded. Microscopic examination shows that each organism has been blown to pieces. With this antigen he is getting very remarkable results. Dr. Pearce of our department has been working with this new antigen with children and has been getting positive results. I think we should not discard the complement fixation test for children until Dr. Pearce reports on the work he is doing. He began it about a year and a half ago, but has been in service abroad and has not been able to publish it.

DR. HEIMAN: I wish to say that I agree with Dr. Sedgwick. We are not to discard the complement fixation test for tuberculosis, but we look forward to a further improvement in the technic.

TWENTY-SIX CASES OF PYLORIC STENOSIS IN PRIVATE PRACTICE WITH OPERATION BY THE RAMMSTEDT METHOD

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During the past four years, twenty-six of my private patients with pyloric stenosis have been operated on by the Rammstedt method. Twenty-four patients were operated on by Downes at the Babies' Hospital, one by Downes at St. Luke's and one by Jennings at the Brooklyn Hospital.

Sex.—In the cases reported, seventeen were boys and nine were girls. The sex of my series of cases agrees with the observation of Still, who reported that among forty-two cases, thirty-five were males. Ibrahim found boys affected four times as often as girls.

Pregnancy.—Thirteen represented the first pregnancy, six the second, five the third, one the fourth and one the fifth. In one, a second pregnancy, the first-born also had pyloric stenosis and died after gastro-enterostomy. All were full term infants.

Age at Operation.—The ages at the time of operation ranged from 3 to 16 weeks. Fourteen were 6 weeks old or less, four were under 4 weeks, eight were from 6 to 11 weeks, and five were from 11 to 16 weeks.

Weight.—The lowest weight at operation was 4 pounds, 2 ounces, the birth weight was 5 pounds 8 ounces. This patient made an uneventful recovery. A 10-pound child was operated on at the sixth week, then weighing 6 pounds 4 ounces, a loss of 3 pounds 12 ounces. This infant recovered. An infant weighing 9 pounds 2 ounces at birth began vomiting at the fourth week. After persistent vomiting for seven weeks he came under my observation. His weight was then 5 pounds 11 ounces, a loss of 3 pounds 2 ounces. He died from exhaustion, twenty-six hours after operation. Twelve had made a gain of from 3 ounces to 2 pounds before the onset of vomiting. Two held their birth weight. In the others the birth weight was not looked on as sufficiently accurate to be recorded. Six held or exceeded their birth weight at the time of operation. These cases of course had made a pronounced initial gain.

Age at Onset of Vomiting.—In a collective study of 266 cases by Ibrahim there were no infants older than 8 weeks at the onset. In my cases, in one, vomiting began at birth, eleven were 2 weeks old or under, twelve between 2 and 4 weeks; one was 6 weeks and one 8 weeks old.

Mode of Onset of Vomiting.—The onset was abrupt in all but one.

Method of Feeding at Onset.—Twenty-three were entirely breast fed at the onset of vomiting, nine were entirely breast fed when they came under observation. In fourteen the nursing had been discontinued because the breast milk had been thought not to agree. Two only had been bottle fed since birth.

Symptoms.—The vomiting in all was projectile. Twenty-three had vomited after every feeding. In the others there was collective vomiting, two or three feedings were retained and then all vomited. There was no regurgitation or mouthful vomiting. All foods and fluids were vomited alike. In twenty-four cases there was retention of food three hours or more after every feeding. In two this observation was not made. The stools and urine were very scanty in all. There was a steady loss in weight in all the patients after the onset of the vomiting. There was no elevation of the temperature in any of the cases. The infants were all very hungry.

The peristaltic stomach wave was present in every case. This is best ascertained by washing the stomach and allowing 2 ounces of water to remain or to give 2 ounces of food. Give the patient a pacifier and then place him on his back with the light favorable for observation. Shortly the wave phenomena will appear.

Tumor was palpable in all cases but one. The tumor may best be palpated when the stomach is empty. In a few cases the tumor will be more readily felt when the stomach contains 2 to 3 ounces of food. It is most frequently located above and to the right of the umbilicus and is a small, oblong, slightly moveable mass.

Postoperative Observation.—In seventeen there was no postoperative vomiting. Nine vomited postoperatively, but all of these infants recovered. One vomited twenty-two times; one nine times.

Postoperative temperature above 101 F. was noted in seven. In one it was 104.8 and in one 103. All recovered.

Observation in the Fatal Cases.—Four cases ended fatally, a mortality of 15.3 per cent. Case 1 was greatly emaciated and had vomited

for seven weeks and had lost 3 pounds, 7 ounces from the greatest weight.

Case 2 had vomited for two weeks and was in fair condition. I advised immediate operation. This advice was not followed. Other physicians were consulted and the infant was treated palliatively for three weeks. He was then brought to me in a wretched condition, having vomited in all five weeks. He was operated on and died of exhaustion.

Case 3 was greatly exhausted before operation, due to prolonged starvation. He had vomited for four and a half weeks and had lost 1 pounds, 5 ounces. He died in collapse five hours after operation. Case 4 had vomited for ten weeks and had lost 2 pounds 10 ounces. In spite of prolonged intermittent vomiting, the child was in fairly good condition. I advised immediate operation, but was persuaded by the family to take the patient under observation for a few days with a view to avoiding operation. The patient developed an acute gastro-intestinal infection, lost rapidly in weight and vitality, and in three days the operative risk had risen over 50 per cent. The child died in collapse five hours after operation.

Postoperative Management. (As carried out at the Babies' Hospital and which has been evolved under the direction of Dr. L. Emmet Holt and Dr. W. L. Downes.)—The infant is wrapped in a warm blanket before leaving the operating room, and when in bed is surrounded by hot water bottles outside the blanket. For an hour or two following operation the head of the bed is kept lowered to prevent the aspiration of mucus into the larynx. This is absolutely necessary while the infant is still under the influence of the anesthetic. When nourishment is commenced, the head of the bed is raised to a level position. Ten or twelve hours later the patient is placed in a semi-erect position, which tends to prevent the regurgitation of food and permits the more easy escape of gas. As soon as the patient is placed in bed a hypodermoclysis of 120 c.c. of normal saline solution is given, and if the condition is poor a hypodermic of adrenalin (1 to 1,000), minims 5, is given, and repeated in four or five hours. Dilute whisky, 5 minims, every three hours for the first five or six days, has proved of great value. Transfusion in a few cases in which there was collapse has been of material benefit, 80 c.c. to 120 c.c. of blood from either parent being given, preferably into the median basilic vein. One and one-half hours after operation, provided the patient has suffi-

ciently recovered from the anesthetic, 10 c.c. of water are given, and one and one-half hours later 4 c.c. of barley water and 4 c.c. of breast milk. Two hours later 8 c.c. of breast milk and 4 c.c. of barley water are given. Breast milk is then given every three hours, alternated with water and gradually increased in amount so that at the end of forty-eight hours about 30 c.c. are given at a feeding with 4 c.c. of barley water. The barley water is then discontinued and on each successive day the amount of milk permitted is increased 5 c.c. at a feeding, so that by the eighth day following operation the patient is having 60 c.c. every three hours. On the third day the intervals of feeding at night are lengthened to four hours, so that seven feedings are given instead of eight. By the time the baby is taking 60 c.c. of breast milk at each feeding he may be put to the breast once. The baby is weighed before the nursing and at intervals of three minutes until he has nursed 60 c.c. from the breast. The following day three nursings are allowed, so that by the eleventh day or twelfth day the patient is nursing entirely and is able to leave the hospital. Measurement of food during the nursing must be kept up until one week later by carefully weighing both before and after. For one month or longer a wetnurse is advisable if the mother is not able to nurse her child.

In well nourished infants a sponge bath is given daily until the wound is completely healed. In emaciated children an oil rub is preferable until such time as the tendency to subnormal temperature has passed.

In cases of vomiting due to accumulation of gas in the stomach the child should be raised to an upright position after feeding. If this does not suffice a soft rubber catheter may be passed into the stomach before each feeding. If still persistent, gastric lavage may be employed. One teaspoonful of castor oil is usually given twenty-four hours after operation if there have been no stools. There should be from two to three stools a day. If more frequent, protein milk is substituted for three or four breast feedings.

Dressing the Wound.—The wound is covered with a narrow fold of sterile gauze held in place by adhesive straps. It is not disturbed for four or five days unless some indication arises. The stitches are removed the ninth or tenth day.

Prognosis. — A low mortality in these cases of pyloric stenosis depends upon early diagnosis and immediate operation. The presence

of a palpable tumor demands prompt surgical interference. The longer operation is delayed in a case with a well marked tumor the greater the surgical risk. This does not mean that a child with a palpable tumor cannot recover without operation. I have had infants with palpable tumor recover, and others that died without operation or because of operative delay. Operation by the Rammstedt method (which means a rapid operation) will insure a mortality of about 5 per cent. in infants that have not vomited more than two weeks. The surgical risk which the patient offers depends in large measure on the duration of the vomiting. It is assumed, of course, that adequate after-care, which includes the use of breast milk, is supplied. It will be observed that my four fatal cases had vomited from four and a half to ten weeks.

A false security in these cases is assumed from the fact that the loss in weight is often temporarily arrested or perhaps has not been excessive. The cases reported represent those infants operated on during the past four years, and not all those that have come under observation; nor do they include those operated on or otherwise treated previous to 1914, when the results were not so brilliant. Sudden and unexpected death in the palliatively treated cases of pyloric stenosis is not uncommon. Acidosis[1] due to defective urinary secretion with retention of the acids may explain these suddent deaths.

Patients treated by nonoperative methods will form the topic of a later communication.

DISCUSSION

DR. HOLT: Our experience in the Babies' Hospital with hypertrophic stenosis of the pylorus (I prefer that term) now comprises over 200 cases. In nearly all of these the diagnosis has been made outside the hospital and the infants are admitted for surgical treatment. During the last two or three years a very large number of infants have been sent to the hospital with this diagnosis in whom the condition was shown not to be present. The wider our experience with this disease is the more we are convinced that in the great majority of cases, at least those of the type which are sent to a hospital, the treatment is surgical. I know that many of the cases of the milder type get well without operation. But very few such cases come under our observation in hospital or consultation practice. We have many times had reason to regret postponing operation, but not of operating too early.

Dr. Kerley has mentioned the mortality of his cases. In 100 consecutive infants operated on in the hospital, in which vomiting had lasted less than four weeks, the mortality was but 8.7 per cent., while in those in which the vomiting had lasted over four weeks the mortality was 50 per cent. This shows

1. Schloss: Am. Jour. Dis. Child. **15**:165, 1918.

very clearly that the chances from operation are very much better if the operation is performed early. While the risk of operation is something to be considered, the risks of not operating are, I believe, greater than, in the hands of an experienced surgeon, is the risk of operation. The Rammstedt operation as performed by Dr. Downes rarely takes more than fifteen minutes, and sometimes only ten minutes.

Hemorrhage occurs in very few cases. The post-operative treatment is quite as important as the operation. We begin feeding as soon as the child comes out of the anesthetic. To withhold food for twenty-four to thirty-six hours after the operation is greatly to diminish the chances of recovery. We begin with breast milk in teaspoonful doses, and very gradually increase the amount until at the end of forty-eight hours the child is usually getting an ounce of breast milk at a feeding. It is important to regulate carefully the amount of food for at least a week, so that we do not put the child to the breast until nine or ten days after the operation. This is necessary because acute indigestion from overfeeding very easily occurs and is often serious.

DR. HOWLAND: I do not wish to advise any special method of treatment, but I think it is possible to cure a great many of these cases without operation, and that therefore it is unwise to say that because an infant has peristaltic waves and a palpable pylorus he must be immediately subjected to operation. In our last thirty-eight cases we have had but four operations performed. Three of the patients that were not operated on died, one of general furunculosis, after having gained 2 pounds in weight, and two within a few hours of their admission. The others recovered. I think a great deal can be done for these cases with careful, consistent, patient treatment. There are some cases that cannot be treated in that way and under some circumstances operation should be done and done at once. Our four operations were successful.

Patients with hypertrophic stenosis of the pylorus cannot usually be cared for properly at home, even if they are nursing infants, and they cannot be treated without operation in a hospital unless a liberal quantity of breast milk is available. If the children vomit their food, they should be refed. Operation does not necessarily cause a cessation of the vomiting in all cases. Some children, after the Rammstedt operation, vomit for several weeks almost as badly as though they were treated by medical measures without operation. Whilst a tumor usually indicates a greatly hypertrophied pylorus, it does not necessarily do so. I remember one child who began to exhibit symptoms of hypertrophic stenosis as late as 9 months of age and came under our care at 16 months. This child had great peristalitic waves and a palpable tumor, yet at operation there was very little hypertrophy. When under the anesthetic at the time of operation, spasm occurred and the pylorus, which had been soft and flaccid, became a hard, firm mass. I think to have immediate recourse to operation merely for the reason that there are peristaltic waves and a tumor, with a child that is in good or fair condition, without waiting for other symptoms, or to see the effect of consecutive measures of treatment, is most unwise. Peristaltic waves may be seen in convalescence when vomiting is long past, and many children with palpable tumors of the pylorus recover without operation.

DR. HESS: I agree with Dr. Howland that operation is not always necessary in these cases of hypertrophic pyloric stenosis. The operation has been so simplified that the tendency is to do it too frequently. The question of prognosis is not merely one of how long the baby has vomited, but of the skill of

the operator. They have at the Babies' Hospital an expert operator. I have seen Dr. Downes operate, and it is remarkable how simple it appears, so that one is likely to get the impression that any capable surgeon can get favorable results except in 10 or 15 per cent. of the cases. That is wrong; it takes a very skilled man to perform this operation and get good results.

In regard to the diagnosis, I think spasm is present in almost every case. Active peristalsis does not necessarily mean a hypertrophy. A catheter can frequently be passed through a pylorus where there is active peristalsis. In the last forty-eight hours of life there may no longer be constipation, but, on the contrary, diarrhea, a marked diarrhea that leads to the child's death. The pylorus may be found relaxed, so that the catheter can be passed through it easily (that is during the last twenty-four hours), whereas during the previous week or two one had been unable to enter the duodenum. The case Dr. Kerley reported is important in reference to the pathogenesis.

DR. CHAPIN: I had one case in which the Rammstedt operation was performed and the child died within forty-eight hours. At necropsy we found that the food had leaked through into the peritoneal cavity. The surgeon had gone a little too far and cut through the mucous membrane. Similar fatal results may have occurred in other instances in which the cause was not detected.

DR. HEIMAN: I believe that in all cases of this kind every one should be treated on its own merits. I think that to place dependence on the length of time vomiting has lasted is not so important as to watch the stools. If the child has only a green, seromucous discharge, that is a better indication of the condition of the pylorus than the appearance of waves or the palpation of a tumor.

DR. RAMSEY: On the question of pyloric stenosis and whether we should operate in the individual case, it seems to me that a progressive loss of weight is always an indication for operation.

DR. HELMHOLZ: I should like to report on the work done by Dr. Sauer and me in fourteen cases of pyloric stenosis. These fourteen children were treated with thick cereal gruel. The suggestion for this treatment in cases of neuritic vomiting came from Dr. Howland's clinic. Using it very successfully in that type of case we used it also in the cases that showed the classical symptoms of pyloric stenosis, inability to retain food or even plain water, peristaltic waves, tumor and obstipation. If the cereal was not thick enough it would not stay down. Thirteen of these fourteen children recovered, one dying of bronchopneumonia two weeks after the vomiting had ceased.

DR. MCCLANAHAN: I have had, in all, fourteen cases of this condition, and the mortality has been higher than Dr. Kerley has given. Nine of the fourteen infants recovered. With one exception all were doing well. Personally, I believe we have cases of spasm and cases of stenosis, and cases of a combination of both spasm and stenosis, but when the stools contain nothing but bile and mucus, then surgical interference is absolutely essential. In one case not operated on, that terminated fatally, a cross section was made of the pylorus and we could not see the lumen of the pylorus; it was completely obliterated. In this case I could not determine a tumor with my finger; the child had lost much weight and there was visible peristalsis.

The surgeon who does my work gets better results each year and completes the operation more quickly by the old fashioned method. The Mayo Clinic

shows that the question of traumatism and exposure of the bowels is a large factor in influencing mortality. I have had a case in which vomiting persisted after operation, and I have seen two postmortems. One of these children died on the fifth day from peritonitis, and the other on the second day after operation from hemorrhage. To me this has been a very interesting study, and I wish to repeat that we may have pylorospasm without stenosis, and these cases will naturally get well without operation.

DR. GRIFFITH: My experience has probably not been as great as that of Dr. Holt and Dr. Kerley, and yet by no means small. I saw this winter six cases within a period of one and one-half months. The first thing to do is to make a diagnosis of pyloric stenosis, and this in my experience is by no means always easy. The next thing is, in theory at least, to determine whether the obstruction is dependent on spasm or on hypertrophic changes. That spasm may exist alone, or at least be the predominant feature, appears to be proved by the large number of reported cases of recovery under purely medical treatment. But when it comes to a clear differentiation between the two forms, I confess frankly that I cannot do it with sufficient certainty to be at all satisfactory. There does not seem to be a single positive distinctive symptom on which we can rely. Certainly the presence of fecal stools cannot be relied on. They merely show that the obstruction is not complete, but nothing more than this. I am sure that I have in the past lost cases by undue delay because the stools were fecal in character. In view of these facts, and of the greatly lessened operative mortality of recent years, my present conviction is that once the diagnosis of obstruction is made, it is unwise to depend on the results of any effort to determine the nature of this as a guide to treatment, but that if improvement does not promptly follow the medical procedures ordinarily advised, recourse should be had at once to operation. I have in the past had cause to regret delay; but have not as yet had reason to regret advising operation.

DR. MORSE: I have been very much surprised at the difference of opinion expressed in regard to hypertrophic stenosis of the pylorus. It is difficult for me to understand how, when months after a gastro-enterostomy has been performed we still find the condition present and unchanged at necropsy, any method of medical treatment can be successful. Personally, I still believe that there are two types of cases, the one a real hypertrophic stenosis, the other a spasm of the pylorus; and that there is a small third class, in which spasm is added to some hypertrophy. When I have made a diagnosis to my own satisfaction of hypertrophic stenosis of the pylorus I want the baby operated on at once. It seems to me that the Rammstedt operation is the operation to do. A good surgeon can have the child off the table in ten minutes.

DR. SCHLOSS: It is possible that in children with a diminished intake of fluid and a lessened secretion of urine there may be a retention of waste products and resulting acidosis.

DR. PISEK: It is a good plan before operation to give a venous injection of saline. I think there is but one side to this question and I agree with Dr. Griffith exactly. When I have a case in which the diagnosis is once definitely made I want it operated on as early as possible.

DR. COWIE: It seems to me that the operative treatment of pyloric stenosis depends on the degree of stenosis present. There are three well recognized types of stenosis, all of which produce similar or identical symptoms. Spas-

modic stenosis, hypertrophic stenosis of large caliber, and hypertrophic stenosis of small caliber. In all there may be spasm, and usually is. In stenosis of small caliber there is no treatment that will do good except operation, for overcoming spasm in this variety does not increase the caliber. In cases of pseudostenosis or spasmodic stenosis or hypertrophic stenosis of large caliber, medical treatment is effective. If we are not careful in the use of the alkalin treatment we may do much harm if we use too much alkali. This must be controlled by stomach analyses. Cases of large caliber may be treated in this way or on the principle of overcoming spasm, and thus be carried along until the caliber enlarges with the growth of the stomach. During the first week we have a case of stenosis under observation a definite diagnosis should be arrived at, and the method of treatment then determined.

DR. KERLEY: My report covered only operative cases. I will take up the subject of cases treated by nonoperative means in a later communication. Practically all the cases reported had been treated palliatively by stomach washing, diet, etc. They were cases of hypertrophy and not of spasm, as proved by operation. It is my experience in something like seventy cases treated by various means, that a palpable tumor calls for operation. I do not mean that a child may not recover with a palpable tumor, but the risk of palliative treatment in such a case is much greater than that of a Rammstedt operation by a competent surgeon.

A CASE OF HIRSCHSPRUNG'S DISEASE

WALTER LESTER CARR, M.D.
NEW YORK

L. S., female, age 6 years, of Italian parentage, was brought to the City Hospital in the ambulance without a history except that she had been constipated for five years and had vomited for twenty-four hours. The child was in a condition of shock, the skin was pale, the lips and fingers were cyanosed and the eyes were staring. There was dyspnea, with gasping respiration. The temperature was 97.5 F., pulse 120. Thirst was intense. The lungs were clear and the heart negative.

The abdomen was greatly distended and there was a constant involuntary discharge of feces. Colonic irrigations of normal saline solution were given, with stimulation, heat, etc., but the symptoms increased in severity. A partial blood count showed red cells 5,100,000, white cells 11,300. The blood was viscid and was not absorbed by Tallqvist paper. The child died eleven hours after admission. A limited necropsy was allowed and I am indebted to Dr. John H. Larkin of the Strecker Laboratory for the following notes, and also for the specimens and photographs.

A small incision was made in the abdominal wall which disclosed a marked distention of the intestines. This was particularly evident in the sigmoid colon, which was bent upon itself. The wall of the upper part of the rectum and the lower part of the sigmoid colon was slightly calcified and the lining mucous membrane was very granular. There was hyperplasia of the mesenteric lymph nodes. Anatomic diagnosis: "Idiopathic dilation of the sigmoid colon (Hirschsprung's disease) with secondary calcification of the lower part of the sigmoid and upper part of the rectum." (Fig. 1.)

A microscopic study of the tissue from this specimen shows a complete loss of mucous membrane, and in its place is a vascularized round cell proliferation of the submucosa. There is a corresponding hypertrophy of the inner and outer muscular coats. (Figs. 2 and 3.)

68 West Fifty-First Street.

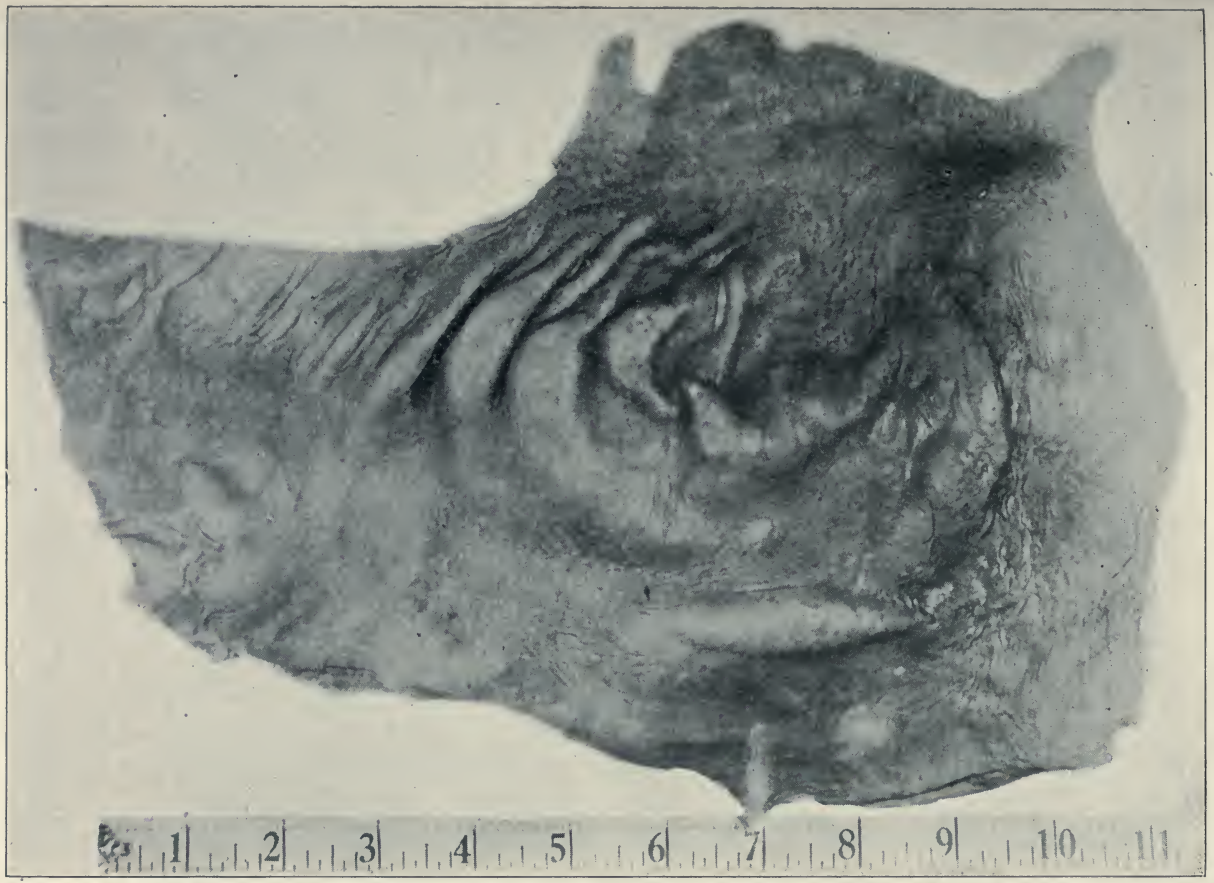

Fig. 1.—Photograph of sigmoid colon after having been opened. Showing irregular granular elevations replacing the mucous membrane. There are scattered, irregular, white scar-like elevations running transversely and longitudinally. Rule and measurements give size in centimeters.

Fig. 2.—Microscopic preparation (paraffin). Low power. × 50. Entire section of gut from mucous membrane to adventitious tissue.

Note 1: Shows mucous membrane which is replaced by a vascular scar-like hyperplastic tissue in which very little evidence of mucous membrane remains.

Note 2: Shows fibroid thickening of submucosa and dense, waxy, fibrous, wavy tissue strands, and thickened blood vessels with a moderate amount of edema.

Note 3: Shows inner muscular coat tremendously hypertrophied by overgrowth of fibrous connective tissue, replacing the musculature. Stains deep red and microscopically gives little evidence of muscle fiber.

Note 4: Shows outer muscular coat moderately thickened. The proportions between inner and outer musculature is 1 to 3.

Note 5: Shows adventitious tissue with longitudinal section of artery and vein having granular thrombi; cross section of nerves showing interstitial neurofibrosis with edema and moderate plasma cell infiltration. From the Strecker Memorial Laboratory, City Hospital.

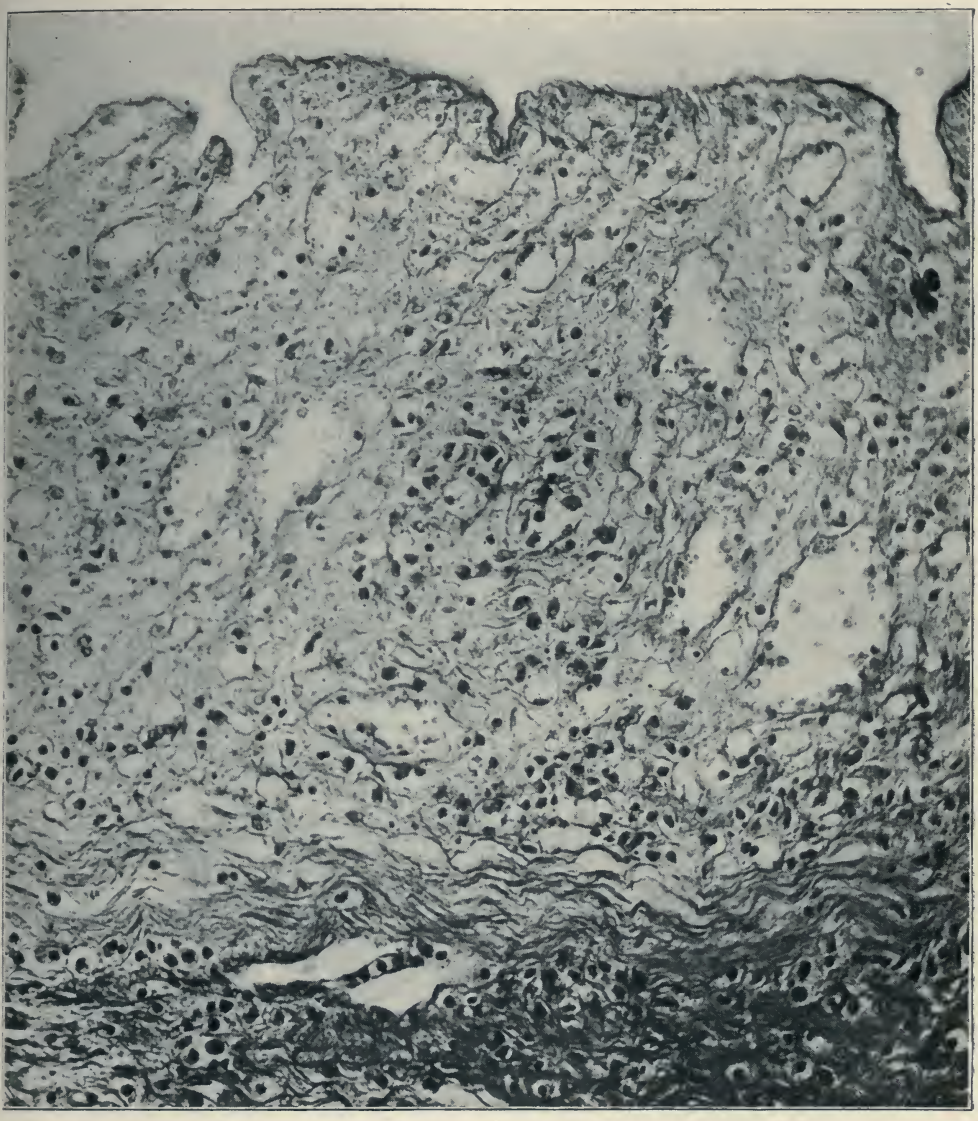

Fig. 3.—Microscopic preparation (paraffin). High power. × 300. The mucous membrane of the sigmoid colon. Only a few remnants of glands can be seen, which have the appearance of cysts lined with epithelium. The mucous membrane is, microscopically, exuberant granulation tissue. In the spaces between the blood vessels, in what remains and might be glands, are scattered plasma and other large fibroplastic cells, irregular in contour, and numerous eosinophils. This transformed mucous membrane rests on a hyperplastic submucosa which is seen in wavy masses and beneath which is the submucous tissue densely infiltrated with plasma and other fibroplastic cells. From the Strecker Memorial Laboratory, City Hospital.

DISCUSSION

DR. KOPLIK: These cases are exceedingly interesting, and it is interesting to see how absolutely ineffective some of our methods of treatment are. Some of these infants die very early. I had a case of a child a few weeks old who passed away with obstruction, and it was confirmed as Hirschsprung's disease. On the other hand, in some cases of obstruction supposed to be Hirschsprung's disease, it has been found that the child only had a large abdomen. Sometimes these obstructions are alleviated by nature, by diet and enemata, and sometimes they go on to obstruction and are operated on and pass away. The prognosis is very bad if one makes an artificial anus. Again, other children have the condition as a result of constipation and a tendency to obstruction. The fatal cases are those in which the intestine is narrowed until obstruction occurs or else the redundant part coils on itself and becomes obstructed. The point I wish to make is that some of these cases go on to adolescence with the condition. I published such a case fourteen years ago in which the condition continued until adolescence and the boy then passed away from obstruction. The condition may be rapidly fatal, or it may go along quite normally for a long time. Usually we do not operate on these children until we have tried medical means, and sometimes the patients will go on to recovery. Again, obstruction will occur apparently out of a clear sky.

DR. HOWLAND: A point not brought out is that there are instances in which there is not only hypertrophy and dilatation, but in which the bowel is extremely long and we find the child with distention which is marked; and in some of these there is no dilatation so far as the roentgen ray shows. I have some roentgenograms that show that the intestine is not much lengthened, and in others it is extremely long, and there is not only great dilatation, but hypertrophy. The treatment and prognosis depend on the type of the disease present.

DR. TALBOT: Dr. Carr has brought up a condition which goes under the name of Hirschsprung's disease. This is the name of a stage in a common condition. When this condition is dignified by the name Hirschsprung's disease it is late in the disease, when the bowel has come to the point of dilatation. The time to treat this condition is before the dilatation has occurred.

DR. KERLEY: At the meeting of the American Medical Association in Detroit two years ago I presented a paper, in association with Dr. LeWald, in which we showed about twenty cases of elongated or otherwise abnormal pelvic colon. I feel that these cases are fairly usual, and the condition known as Hirschsprung's disease is probably the outcome of a congenital elongated sigmoid. The gut, because of its elongation, becomes saculated and dilated, and there is constipation and oftentimes constriction. I have a roentgenogram of a sigmoid showing marked dilatation and constriction with a capacity of two quarts. Abnormalities of the pelvic colon, as I said before, are frequent, and in marked cases may go on to the formation of gross lesions.

DR. HEIMAN: Dr. Jacobi pointed this out fifty years ago. The first of the condition is megacolon and constipation. Later, when interstitial changes develop and considerable obstruction ensues, it may be termed Hirschsprung's disease.

DR. PORTER: I wish to take issue with what has just been said. Congenital megacolon is found at birth and even in the prematurely born child. I have been able to place on record a number of cases; one of these was in a child

which showed the condition fully developed at birth. The child died and I have the pathologic specimen which shows all the characteristics of Hirschsprung's disease as it occurs in the older patients.

DR. KOPLIK: Hirschsprung thoroughly described this as a congenital condition or an anomaly. I have pictures of a new-born baby in which both the roentgen ray and the necropsy show most marked Hirschsprung's disease, and I have one anomaly that shows the most marked tying down of the gut and a short mesentery, which could not be produced by constipation.

DR. DUNN: I want to agree with Dr. Porter and Dr. Koplik. It is only at the necropsy table that we see very much of this disease. In regard to the question of whether it is an acquired condition due to muscular effort or whether it is congenital, I have seen two cases in the first week of life, in which it could not have been produced by prolonged constipation and must have been congenital.

DR. TALBOT: If you will think back, I spoke of a condition and not of a disease. If you will look over the diagnoses in the hospitals you will find that the condition is called Hirschsprung's disease irrespective of whether it is congenital or acquired. The pathologic progress of the disease shows different stages; there may be bands and a physiologic dilatation. The term Hirschsprung's disease is loosely applied to all these stages of the condition, and that is the origin of this discussion. What I want to bring out is that there is a condition which develops into clinical Hirschsprung's disease and which can be prevented from so developing by the application of appropriate measures.

DR. KERLEY: How does Dr. Koplik know whether the condition is congenital or acquired? What are the methods of differentiation?

DR. PORTER: Hirschsprung differentiates between the condition that is congenital originally and that which is entirely acquired. In the condition that is originally congenital there is a type of muscular hypertrophy throughout the colon very similar to that seen at the pylorus in hypertrophic stenosis. We are strongly urged by Hirschsprung not to consider any acquired enlargement of the colon as classifiable with the disease he originally described.

DR. DUNN: If we are going to call this thing a disease the diagnosis must be based on the condition and not the ground that it is a clinical entity.

DR. MORSE: I would suggest that each one when he goes home should read Hirschsprung's original article.

A BRIEF REPORT OF AN INFANT WITH CONGENITAL STRICTURE OF THE DUODENUM: OPERATION — DEATH

H. M. McCLANAHAN, M.D.
OMAHA

CASE REPORT

Baby P., born Dec. 9, 1917. Labor normal. Health during pregnancy good. The mother has two older children living and well. Both reared on the breast. The infant cried promptly and progressed nicely until the third day, when it began vomiting a grass-green, acid fluid, vomiting occurring from three to four times during each twenty-four hours. I was called to see this infant in an adjoining town on the fifth day. Weight 7 pounds. Vital organs normal. Abdomen not distended. Palpation of the abdomen revealed nothing. Infant took the breast readily. Stools on this day were still dark in color. No elevation of temperature. As the mother's milk was very yellow in color, I advised giving the infant ½ ounce of sterile water containing 2 grains of sodium citrate a few minutes before each nursing. Nursing periods every three hours. Vomiting continued on an average of three or four times daily, apparently very large quantities of green, acid fluid. The mother brought the infant to the Methodist Hospital on the tenth day and remained in the hospital from December 19 to December 31. Taken from the breast from December 21 to December 26, and placed on a mixture of whey, milk, water and soda solution. As the attacks of vomiting continued, and as the infant lost weight more rapidly, the breast milk was resumed on December 26. From that date until the 31st it made a gain of 4 ounces in weight, but never vomited less than twice in twenty-four hours. During this period the stools became yellow in color. The mother returned home December 31. From that date until January 4 the vomiting increased in frequency and the stools became green in color. Returned to the hospital January 4. From that date to January 11 the baby lost 9 ounces in weight. Vomiting continued as before. December 22 the child was given barium in the milk. The roentgenogram revealed a large shadow over the stomach, but a distinct shadow well down to

the colon, showing that the pylorus was pervious. At no time was any peristaltic wave visible. I was never able to palpate any mass. On two occasions when washing out the stomach, it retained 10 ounces of fluid before there was any return. From January 8 to 11 the bowel movements were all dark in color, not offensive, composed almost entirely of bile and mucus. At no time was there any elevation of temperature. Exploratory incision had been discussed. The parents urged waiting, but on January 10 they gave their consent to an operation. I quote as follows from the report made by the surgeon, Dr. A. F. Jonas:

"Baby P., aged 5 weeks, male, residence, Blair, Neb., was referred to me with symptoms indicating a congenital intestinal obstruction, but the symptoms were not classical. The child was markedly emaciated, due to the inability to retain food. The writer concurred in Dr. McClanahan's diagnosis of pyloric spasm or duodenal stenosis, and an operation was decided on. It was done Jan. 11, 1918. The anesthetic was ether.

"Through a median incision, the stomach crowded itself out of the abdomen on account of its great distention. The pylorus was moderately constricted by a distinct circular induration, but it did not appear to be sufficient to account for the gastric distention.

"It was further noted that the duodenum, itself, was greatly distended. In following this down to the point where it passes through the transverse colon, a very marked constriction was encountered. The transverse colon was then pulled out through the wound, after the stomach had been crowded back into the abdomen. The jejunum, from the fossa of Treitz downward, was found to be collapsed; all of the distention was above the mesocolon.

"On examining the opening in the mesentorium, a constricting band compressing the duodenum 8 inches beyond the pylorus, was found. This band belonged to the mesentorium and not to the intestine. The band was divided, and the distention in the duodenum was relieved at once.

"On account of the distinct pyloric constriction and the probability of a recurrence of the condition in the fossa of Treitz, it was considered advisable to do a posterior gastro-enterostomy. This was accomplished without difficulty. The patient was returned to bed, apparently in good condition. The child died very suddenly during the night.

"A postmortem examination could not be obtained and, therefore, the cause of death was uncertain."

In conclusion: I believe, and this opinion was concurred in by other members of the staff, that we had some obstruction, but it did not seem typical of stenosis. The constant vomiting of bile — the absence of peristaltic wave — led me to believe the pylorus was pervious. The fact that for some days there were normal stools and gain in weight, led me to infer there was no permanent obstruction. It seems probable the compressing band acted intermittently in closing the lumen of the duodenum. I am frank to admit that the operation was deferred too long; that had an operation been done at the end of the first week, the prospect of recovery, at least, would have been better.

DISCUSSION

DR. TALBOT: This case is like one that came into our service and finally came to necropsy. There was a constricting band over the duodenum, and the interesting point was the obstructive vomiting only for a part of the time. After we had observed the child for about a week, it was found that he spent most of his time in the knee-chest position. When he was in that position he did not vomit. The pressure of the band that went over the duodenum was relieved by that position and the food could pass through.

DR. PORTER: Dr. McClanahan's case reminds me of two cases I have seen; the one came to necropsy and the other recovered after operation. When I saw the program I thought Dr. McClanahan's case was one due to constriction at the insertion of the ducts in the duodenum. The cases I have to mention were of this type. In the first case the child had a very narrow stenosis and survived until it was 18 months old. The diagnosis of pyloric stenosis was made several times by several observers, and on that supposition the child was operated on. In this case, when we opened the abdomen the duodenum sprung into view and looked like a dilated horseshoe stomach, but the position of the pyloric vein gave us our bearings. In this child a posterior gastro-enterostomy was performed and we later obtained the specimen of which I show a photograph.

The second case occurred seventeen months ago in a new-born baby. The symptoms of pyloric stenosis were present and there was constipation and a very marked peristaltic wave over the abdomen, and we felt that at this age the child would hardly have a hypertrophic pylorus, so a diagnosis of duodenal stenosis was made. I asked Dr. Weeks to do a gastro-enterostomy which he hesitated to do because he thought the child's condition was hopeless; it was dried up and weighed less than 4 pounds; however, the gastro-enterostomy was done, the child made a slow but steady recovery, and now is 17 months old and weighs 17 pounds.

DR. LA FÉTRA: I have seen one of these cases at necropsy and another during life and the symptoms were very much like those of hypertrophic pyloric stenosis. In one there was a good deal of constriction and narrowing of the duodenum; in the other a band constricted the duodenum.

A CASE OF CARDIOSPASM

FOLLOWED BY HYPERTROPHY, DILATATION, AND STRICTURE OF THE ESOPHAGUS, TREATED BY GASTROSTOMY, AND SUBSEQUENT DILATATION OF THE ESOPHAGEAL STRICTURE

EDWIN E. GRAHAM, M.D.
PHILADELPHIA

The case here reported is of special interest for several reasons. The diagnosis of cardiospasm is made because clinically the element of spasm is unquestionably present, the food entering the stomach at certain times very much better than at other times. Sodium bicarbonate and sodium bromid seemed to assist in causing the food to enter the stomach. The diagnosis of stricture of the esophagus is verified by roentgen-ray plates, the first plate showing a thin stream of barium just entering the stricture, with a dilated portion of the esophagus above the stricture; the second plate shows the barium in the lumen of the stricture, and the third plate shows the barium meal just entering the stomach. Another point of special interest is that the diagnosis of ulcerative esophagitis was made by direct inspection with the eye, the esophagoscope being passed by Dr. Chevalier Jackson and the ulcerated area being clearly seen.

The treatment by gastrostomy, feeding the child through a tube for several weeks, nothing being allowed by the mouth except small quantities of water, is also of interest, and finally the treatment by dilating the stricture of the esophagus by sight, and not by touch, the esophagoscope being passed, and Dr. Jackson passing bougies—small, delicate bougies at first—by sight, and not according to the old method, in a blind manner.

I might also say that there is now in the Jefferson Hospital another child with a stricture of the esophagus caused by the swallowing of lye, who is being treated in the same manner—gastrostomy, feeding by a tube inserted into the stomach, and the stricture being dilated by bougies passed through the esophagoscope, the operator clearly seeing the small opening remaining in the esophagus, and consequently being able easily and quickly to insert the small bougies into this opening.

REPORT OF CASE

History.—The history is that of a boy, George S., who first came under my observation Sept. 4, 1916. He was then 4 years and 10 months of age. He was apparently healthy at birth and had one sister 10 years of age, healthy and strong. There were two miscarriages since the birth of George, the first without any apparent cause, the second due to a fall.

The child was put to the breast a few hours after birth, was nursed for one month, and vomited after the first nursing. This vomiting had continued ever since. He usually regurgitated or vomited immediately after eating. He suffered from habitual constipation. He spat up his food within a few seconds after swallowing it; would eat quickly and swallow without any difficulty any food given to him, but regurgitated it in from a few seconds to a few minutes. Occasionally he had pain, usually at night, and commonly in the region of the ensiform cartilage and epigastrium. A few weeks prior to admission, the mother informed me, the boy was given a 5-grain capsule filled with barium, and that this was seen fluoroscopically to pass into the stomach without difficulty. As a rule he had no trouble swallowing liquids, although occasionally he regurgitated liquids, but he always regurgitated all foods except liquids. There was no abdominal distention, and only occasional abdominal pain.

The boy was decidedly rhachitic, did not creep until he was 15 months old, and first stood alone when he was 18 months old. He was born in November and was kept in the house until the following July.

When 8 months old he was fed on condensed milk for one month, and vomited very little. The vomiting then gradually returned. This was the only time in his life that he ever went more than twenty-four hours without vomiting, and he had never gone for twenty-four hours without vomiting when he was given anything except liquid food. Weight 32 pounds, 5 ounces. He had only had one attack of diarrhea, and this lasted only three days. He was never drowsy or toxic. He was put on an absolutely liquid diet, with small amounts every three hours, and was given 3 grains of sodium bicarbonate before each feeding, and 5 grains of sodium bromid three times a day.

Oct. 11, 1916. The child was given a little zweibach every day, and only vomited it twice. This was the first time that he ever retained any solid food. Sodium bromid and bicarbonate were continued.

Oct. 18, 1916. Given five feedings a day—milk, clear broths, zweibach, crackers and butter, raw egg, and a little cereal; vomiting decidedly less; weight, 33 pounds, 9 ounces.

Oct. 25, 1916. Suggestion was tried. He had an inclination to spit up after each feeding, but if his mind was occupied, that is, if he was made to count, or if he was told a story, or told that he must not spit up, he would very often not vomit. The mother said that she believed the condition was mental. If she sat with him for an hour or so each day and told him not to vomit, the vomiting was controlled to a certain extent. There was always a great deal of mucus that came up with his food. The mother said that it was "not the food but the child." Sometimes after taking the food, the boy would say, "I must spit." Sometimes he would put his hand to his throat and look distressed, and at times would spit up the food, or at other times this distressed look would suddenly disappear, and he would be able to finish his meal without trouble. Weight 36 pounds.

March 28, 1917. If the boy was given only a liquid diet, and the bicarbonate of soda and bromids, he had gone as long as one week without spitting up anything. Before spitting up any food he was apt to cry, and say, "I want to spit." Sometimes he could be diverted; at other times he could not, but he could always hold the food two or three minutes until his mother could bring him a basin to spit in. This delay was intentional on the part of the mother. Weight, 38 pounds.

For some weeks he had been taking small doses of bismuth subnitrate with the hope of healing the ulceration of the esophagus. A Wassermann was negative, and a tuberculin test negative. An examination made by Dr. Philip B. Hawk of the Jefferson Medical College showed that the food he spat up immediately after swallowing it did not reach the stomach, but the food that he spat up some minutes after it had been swallowed had reached the stomach.

The boy is at present in my ward at the Jefferson Hospital, and his general condition is very satisfactory.

1713 Spruce Street.

BALANTIDIUM COLI INFECTION WITH REPORT OF A CASE IN A CHILD

L. R. DeBUYS, B.S., M.D.
NEW ORLEANS

There appeared in my service in the outpatient department of the Touro Infirmary in New Orleans an interesting and unusual case of dysentery which because of the age of the patient, the source of the infection and the character of the organism found deserves recording if for no other reason than as a reminder of another possible etiologic factor in the production of frequent stools. The infrequency of many diseases in childhood undoubtedly is in great part due to lessened exposure incident to age. This explanation advanced several years ago in the instance of amebiasis in children may also be suggested for the rare infection in childhood of this unusual offender in man.

While the case was not observed for as long a time as would have been preferred, nevertheless for the foregoing reasons and because of the easy means of its recognition, this case of *Balantidium coli* in a child is reported.

REPORT OF CASE

History.—A colored boy 5 years of age was brought to the outpatient children's department at Touro Infirmary by his mother who stated that the child had been having a diarrhea for nearly a year, but that recently she noticed blood in his bowel movements. During the period from the first attack of diarrhea to the present time there had been intervals when the child was apparently well and had no bowel trouble. With this last attack, however, blood had appeared and he seemed sicker than ever. The attacks were progressive in severity, each one being worse than the one preceding. He strained when his bowels moved, complained of pain in his stomach, had no appetite, and had been losing weight. He had been accustomed to help "round up" the pigs in the pen every day and frequently would eat some food which he would hold in his hand while helping with the pigs. It was his habit also to go into the pen at times when he ate his food.

The family history was negative, except that the father, who tended the pigs, had a diarrhea a short time previously, the character of which could not be ascertained.

Past History.—The patient was a full term child. He had never been ill before the diarrhea, and had always been nourished as other children of his race.

Physical Examination.—This showed a patient poorly nourished but fairly well developed. His skin was dry, as was his tongue and mouth. There was

a catarrhal stomatitis. His eyes were sunken. His lungs, heart, liver, spleen and abdomen were negative except for some tenderness over the lower abdomen. The nervous system was also negative.

A rectal tube was passed and some bloody mucus obtained, which was immediately examined and revealed the presence of *Balantidium coli.*

As there were no beds available at Touro Infirmary he was referred to my service at the Charity Hospital, but unfortunately he never appeared at the hospital and was lost sight of.

Description of Organism.—The organisms seen in this case belonged to the infusoria variety of the protozoa and are known as *Balantidium coli.* They were oval-shaped, more pointed and tapering at one end and rounded at the other, and measured from 0.07 to 0.1 mm. in length by 0.05 to 0.07 mm. in breadth. The mouth was funnel-shaped and situated on the ventral side of the organism a little below the anterior or pointed pole. A thick layer of long cilia was found around the peristome, which continued actively a circulatory motion, and by the use of which the organism grasped its food: various cells, bacteria, and blood cells. The funnel-shaped mouth extended backward and downward and communicated with the endosarc.

The endosarc consisted of granular matter both fine and coarse and highly refractile, inclosed in a thin and very transparent sheath, which was a continuation of the gullet above and which ended at the anus situated at the posterior or more rounded pole. A kidney-shaped nucleus, which changed its position with the motion of the granular matter, was found in the endosarc usually below and to one side of the peristome. Vacuoles were seen in the endosarc numbering from one to six, usually two, and were apparently contractile. These vacuoles according to Stein[1] are connected by lacunae, which probably explains the large single vacuole sometimes seen which occupies the whole lower third of the parasite.

A thick cuticle longitudinally striated inclosed the endosarc and was separated from it by a narrow rim of homogeneous protoplasm (the ectosarc). These striations, undoubtedly muscular structures, extended from the peristome on the ventral surface and from a corresponding level on the dorsal surface to the anus of the posterior pole.

Cilia extending throughout the entire length of these striations controlled the movements of the parasite.

By means of these cilia and muscular bands the parasite was able to move with tremendous rapidity and comparative ease through fields containing large particles of matter. The parasite was capable of changing its shape and direction with great facility by contracting the muscular bands.

At times the organisms appeared quite round.

Encysted forms of the parasite have been described by Leuckart[2] and Stein,[1] in which the organism becomes rounded, loses its cilia, the endosarc contracts and contains fat globules, the nucleus becomes obscured, and it is surrounded by a thick capsule.

1. Stein, F.: Bohmisch. Genzell der Wissenchaften, 1860, p. 165; Amtl. Ber. d. Karlsbad, Naturforch., 1862.

2. Leuckart: Die menschlichen Parasiten, 1863, p. 1; Parasiten des Menschen, 1879, p. 3.

From the careful observations of Bel and Couret[3] through the entire cycle the method of reproduction of these infusoria is by budding conjugation and binary fission. Many other methods of conjugation and reproduction have been described by Wising,[4] Woit,[5] Gurvich,[6] Bushuyeff,[7] Lavrovskaya,[8] Zhegaloff[9] and Doflein.[10]. The observations of Bel and Couret[3] with regard to reproduction conform to those of Ekecrantz,[11] Wising,[4] Leuckart,[2] Strong[12] and others.

Conflicting results have been obtained from animal experimentation by Wising,[4] Lavrovskaya,[8] Strong,[12] Zhegaloff,[9] Rapchevski,[13] Chigayeff,[14] Vlayeff,[15] Cassagrandi and Barbagello[16] and Chichulin[17] by injecting feces containing balantidia in cats, dogs, rabbits, pigs and monkeys.

Grassi and Calandruccio[18] produced no results on themselves after injecting balantidia from the hog.

Leuckart[19] describes these organisms as being much less sensible to the influence of water and cold than other nomads, and as preserving their viability and motility for long periods in water at ordinary temperature. Klein[20] recognized an organism which he believed to be *Balantidium coli* which he secured from sewage and which after being

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3. Bel and Couret: Balantidium Coli Infection in Man, Jour. Infect. Dis., 1910, **7,** 609.
4. Wising, P. J.: Nord. med. Arch., 1871, **3,** No. 3, Stockholm; Ibid., Svensk. Läk. Sällsk. Handl., 1885, p. 48, Stockholm.
5. Woit, O.: Deutsch. Arch. f. klin. Med., 1897, **60,** 363.
6. Gurvich, M. J.: Russk. Arch. Patol., I. Bakteriol., 1896, **2,** 804.
7. Bushuyeff, V. F.: Voyenno-medic. Jour., 1897, p. 188, Med. Spec. Part, p. 167.
8. Lavrovskaya, Y.: Bolnitch Gaz. Botkina, 1891, No. 11, p. 304, St. Petersburg.
9. Zhegaloff, J. P.: Klin. Jour. Mosk., 1899, **1,** 44.
10. Doflein, F.: Die Protozen als Parasit. u. Krankheitserreger, Jena, 1901.
11. Ekecrantz, W.: Nord. Med. Arch., 1869, p. 1, Stockholm.
12. Strong, R. P.: Dept. of Interior, Bureau of Govt. Lab. Biol. Survey, No. 26, December, 1904.
13. Rapchevski, I. F.: Vratch, St. Petersburg, 1880, p. 505; Med. Vestulk, St. Petersburg, 1882, **21,** 361, 377 and 393.
14. Chigayeff, N. F.: Vratch, St. Petersburg, 1898, **19,** 1441.
15. Vlayeff: Vratch, St. Petersburg, 1898, **19,** 140.
16. Cassagrandi and Barbagello (Quoted by Strong, Footnote 12).
17. Chichulin, G. N.: Voyenno Med., 1900, **78,** Med. Spec. Part, p. 3059, St. Petersburg.
18. Grassi and Calandruccio: Acc. d. R. Acad. d. Linc., Roma, 1888, 285, series 4, vol. 4, p. 700.
19. Leuckart: Brit. Med. Jour., Dec. 19, 1896, p. 1797.
20. Klein, E.: Brit. Med. Jour., 1896, **2,** p. 1852.

bottled in sewage lived and were yet motile in thirteen weeks. On the other hand, Malmsten[21] concluded that the parasite is short lived, since it died shortly after removal from the intestine, and Zhegaloff[9] was of the same opinion. From the various statements made by observers it may be said that the length of time the organism may live is variable. Attempts to prolong their lives in feces by Bel and Couret[3] were unsuccessful at various temperatures, as were also their attempts at the cultivation of the organism. Other observers have met with the same negative results, and Strong[12] states that the parasite has not been grown or isolated in pure cultures.

Balantidium coli were probably first observed by Lieuwenholk[22] in his own stools in 1857. In 1857 Malmsten and Loven[23] first described them as *Paramecium coli,* and five years later (1862) Malmsten[24] reported two cases. Stein,[1] in 1862, proposed the name of *Balantidium coli.*

In 1891 Mitter[25] was able to collect only twenty-eight cases. Strong,[12] in 1901, only 117 cases, including reports from Africa, Cochin China, Cuba, Finland, Germany, Italy, North and South America, Philippines, Russia, Sunda Islands and Sweden.

In the United States probably the first case to be reported was in Iowa by Mitter[25] in 1891. Since then cases have been reported by Bel and Couret,[3] 1 in Louisiana; Gray,[26] 3 in Arkansas; Deaderick,[27] 1 in Eastern Arkansas; Sistrunk,[28] 1 in Minnesota; Rockefeller Sanitary Commission,[29] 2 in North Carolina and 1 in Mississippi; Jennings,[30]

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21. Malmsten, P. H.: Allg. med. Centr. Ztg., Berl., 1858, **27,** 81.

22. Lieuwenholk: Quoted by Strong, Bull. Johns Hopkins Hosp., 1901, **12,** 31.

23. Malmsten, P. H., and Loven: Infusurier säsom intestinaljar homemeskan, Hygeia, Stockholm, 1857, **19,** 491; Virchows Arch. f. path. Anat., 1857, **12,** 302.

24. Malmsten, P. H.: Quoted by Strong and Musgrove, Bull. Johns Hopkins Hosp., 1901, **12,** 31.

25. Mitter, J. J.: Beitrag z. Kenntness zur Balantidium Coli in Menschlichen Darmkanale, Kiel, 1891.

26. Gray, D. A.: St. Louis Med. Rev., April 27, 1907.

27. Deaderick: Endemic Diseases of Southern States, 1916.

28. Sistrunk, W. E.: Intestinal Parasites Found in Individuals Residing in the Northwest, Jour. Am. Med. Assn., 1911, **57,** 1507.

29. Rockefeller Sanitary Commission Reports, 1911, 1912 and 1913.

30. Jennings: New York State Jour. Med., 1912, **12,** 179.

1 in New York; Bowman,[31] 2 in the Philippine Islands; and Young and Walker,[32] 1 case in Oklahoma.

In all, the literature contains considerably less than 150 reported cases of this infection in man. Men have been infected twice as frequently as women, and in the cases reported all have been adults with the exception of two cases in children.

The habitat of this infusorium in the human being is in the large intestine, but they have been found in the appendix (Malmsten[21]).

Leuckart[33] was the first to show the pig to be the normal host of the *Balantidium coli.* He suggested that the possible way infection occurred was by the entrance of the freshly voided parasites into the alimentary tract of the human being. He also suggested ingestion of the organism in the encysted state as a probable method of infection.

Deaderick[27] says that besides the domestic pig, certain species of monkeys serve as hosts for the balantidium.

The observation of Klein,[20] who found an organism he believed to be the *Balantidium coli* in the sewage of London, and also in the drinking water of the same city as delivered to the consumer, suggests the entrance of the organism through drinking water as a means of infection.

It is of interest to note that in about 25 per cent. of the cases reported infected with *Balantidium coli* there has been either direct contact with swine or the infection has followed ingestion of food products from pork.

An entire family infected with *Balantidium coli* after eating sausages made from a hog which had harbored the organism is reported by Chichulin.[34]

Henschen[35] especially emphasizes the pathologic importance of the parasite, while other authors are inclined to believe the presence of the parasite to be an accidental or unimportant complication.

In 1900 Opie,[36] in his article on protozoa, concludes "that *Balantidium coli* is apparently an accidental parasite which finds favorable

31. Bowman, F. S.: Studies in Balantidium Infection, Med. Rec., New York, April 22, 1911.

32. Young, A. O., and Walker, O. J.: Balantidium Coli Infection in Oklahoma, Jour. Am. Med. Assn., 1918, **70,** 507.

33. Leuckart: Weighman's Arch., 1861, **1,** 80, Plate V, Fig. A, B; Die menschlichen Parasiten, 1863, p. 146; Fig. 21, p. 744.

34. Chichulin, G. N.: Loc. cit., Footnote 17.

35. Henschen: Quoted by Strong and Musgrave, Footnote 42.

36. Opie: Twentieth Century Practice of Medicine, 1900, **19.**

conditions for growth in the diseased intestine, and that it is improbable that the organism is the etiologic factor in the production of the diarrhea with which it is associated."

McFarland[37] holds that the organism is not certainly parasitic, but perhaps merely commensal; that is, it inhabits the body of its host, but without any effect on the host either detrimental or advantageous.

Malmsten[21] and Doflein[10] believe the organism to be harmless, but Strong,[12] Brooks,[38] Solowjew,[39] Bel and Couret[3] and others believe the balantidium is an important etiologic factor in the production of the catarrhal and ulcerative lesions of the large intestine in the infection associated with its presence.

Certainly the cases of Strong and Musgrave[40] and Bel and Couret,[3] which have been so carefully and minutely studied, are conclusive evidence of the pathogenicity of the organism. To quote their conclusions:

Strong and Musgrave:[40] We cannot regard this parasite as a harmless one for we could not explain the persistent diarrhea of our patient without regarding it as the exciting cause, nor were we from the lesions found at necropsy enabled to explain his death in any other way.

Bel and Couret:[3] Finally, from the definite and constant microscopic findings and negative blood and cultural results for other intestinal invaders, the logical conclusion seems to be that *Balantidium coli* is not a harmless commensal, as some suppose, but an organism able to invade the human tissues and cause a serious disease; death may follow through compression of the intestinal glands by a hyperplasia of interglandular tissue produced by the parasites and through glandular necrosis and absorption of toxins from any terminal bacterial invasion.

The infectious character of the *Balantidium coli* is seen in the observations of Brooks[38] on a fatal dysentery among the apes in the New York Zoological Garden, and the pathology of the infection in man is clearly shown by the necropsies and studies of Strong and Musgrave,[40] Solowjew,[39] and Bel and Couret.[3]

The organisms invade all the coats and blood vessels and lymph channels of the large intestine and the neighboring lymph glands, and produce a hyperplasia and cell infiltration either mechanically or through the liberation of cytolytic ferments. Ulcers which are small and shallow and mostly limited to the mucosa are found which are probably due to the terminal invading bacteria, the balantidium coli

37. McFarland: Quoted by Jennings, Footnote 30.
38. Brooks, H.: New York Univ. Bull. Med. Sc., January, 1902.
39. Solowjew, N.: Centralbl. f. Bact., Ref., 1901, **29,** 821 and 849.
40. Strong and Musgrave: Bull. Johns Hopkins Hosp., 1901, **12.** 32.

primarily producing avenues of entrance, as they are absent from the walls of the ulcers; some, however, penetrate the muscularis mucosa. The organisms produce a subacute or chronic inflammation of the interglandular tissues and submucosa.

The presence of the organisms in the blood vessels and lymph channels argues for the possibility of carrying infection to the liver and lung through these routes (Couret and Bel[3]).

The patients suffering with this infection may have digestive troubles, but usually have a diarrhea or dysentery. The stools are liquid and may contain undigested food. There is usually mucus or blood, the stools resembling those seen in amebic dysentery. These may be from a few to many in the course of the twenty-four hours. Tormina and tenesmus are frequent, the latter particularly if the lesions are situated near the anus.

The symptoms may subside for a period, to begin again. In those cases of prolonged duration anemia may be found and there is great loss of weight. At times there is edema. In some cases severe and pernicious anemia has been suspected. The course of the disease is usually progressive.

Examination of the blood usually shows slight variations from the normal and there may or may not be an eosinophilia.

The skin is dry, the temperature is normal or there may be a rise up to 99 F. Hebetude is present to a greater or lesser degree, the tongue is dry, at times a stomatitis may be present. The lymph nodes are occasionally enlarged. Emaciation is a common symptom.

The urine shows nothing of interest.

Proctoscopic examination usually reveals the rectum and lower colon lined with thick, bloody mucus covering the shallow ulcers which readily bleed.

The diagnosis is promptly made by the examination of the stools or by introducing the rectal tube and examining some of the bloody stained mucus, when the characteristic organisms are easily discernable. By examining the fresh specimen while it is still warm the parasite is found to be very active, but it becomes more sluggish as its surroundings become colder.

The duration of the diarrhea in patients known to be infected with the parasites has been as long as fifteen years.

All the reported cases, with two exceptions besides this one, have been in adults. The age of this patient is next to the youngest recorded, the other two being 4 years and 5⅓ years, respectively.

The prognosis depends on the ability to rid the host of the balantidia. Many cases are shown wherein the relative decrease in the numbers of the parasites is coincident with a corresponding improvement of the patient.

Remembering the pathology of the disease, with its possible complications in the liver and lungs, it may be said that the earlier the diagnosis and the more thorough the treatment the better the prognosis. The mortality has been given as high as 30 per cent. by Strong.

From the information available the prophylaxis should be directed toward the care and hygiene of those who are in close contact with the care of swine and the manufacture of pork products, and the thorough cooking of the pork products before ingestion. If to this is added a safe water supply, prophylactic measures against this infection will be as complete as our present knowledge will warrant.

Many drugs have been employed in the treatment of this infection, mostly by colonic flushing and by enema. Quinin, tannic acid, silver nitrate, iodin, acetic acid, salicylic acid and boric acid, methylene blue, thymol in olive oil followed by castor oil, have all been employed. By mouth arsenic and thymol have been used.

There is as yet no known specific in the treatment of this disease, but because of the resemblance of this infection to that of amebic dysentery: (1) in the invasion and location of the organisms in the tissues; (2) in the histologic pathology; and (3) in its clinical manifestations, it would seem that ipecac or its alkaloid, emetin, should be employed, as it is hardly to be expected that local flushings will be of any avail after the infection is established.

If in reporting this case I may only have stimulated interest as to the possibility of this parasite being a cause of frequent stools and placed the physician on guard for the recognition of this infection, which has been shown to exist not only in tropical and subtropical climates, but in the colder climates as well, where the symptoms are less severe, I will feel that the purpose of this paper will have been subserved.

Note.—Since writing this paper another case has come to my knowledge in which emetin was employed in its treatment, and, I am told, with spectacular results.

DISCUSSION

Dr. Hess: I know a few have found *Balantidium coli* occasionally as an accidental occurrence in the feces where cultures were made for dysentery bacilli. I would like to know whether the *Balantidium* was found in the father's case, and whether when the child was cured the *Balantidium* were still found?

Dr. DeBuys: In reply to the questions asked by Dr. Hess, I may call attention to the statement made in my paper that the case was not followed as long as I should have liked. The case was clearly one of *Balantidium coli* infection. The organisms were found, the diagnosis made, but the child was unfortunately lost sight of. In my paper reference was made to the cultivation of the organism and also to animal experimentation by other observers. Cultivation has been unsuccessful and the reports on animal experimentation have been conflicting.

Klein stated that the organism had lived as long as thirteen weeks; on the other hand, most of the observers have shown that the organism dies in a short time after removal from the intestine. The reproduction of the parasite is by budding, conjugation and binary fission.

The father of this boy was never seen so I am unable to say whether he had the same kind of an infection or not. In analyzing the symptoms of the disease as described in the reported cases, I have considered the results of the observations of other men. It has been shown that where the number of organisms decreased there was a comparative improvement in the health of the individual.

Since writing this paper another case has come to my knowledge in which emetin was employed in its treatment, and, I am told, with spectacular results.

A CASE OF "CRIBBING" IN A YOUNG INFANT. DILATED STOMACH: SPASM OF THE DIAPHRAGM

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PITTSBURGH

March 5, 1918, I was called to see Robert M., then 8 weeks old. He weighed at birth 9 pounds, 7½ ounces, and at the time of my visit 8 pounds 2 ounces, but had gone down during this interval to 7 pounds 11 ounces. He was breast fed for three weeks, but had had during the third week a supplementary feeding of a cream mixture and then condensed milk. Had always vomited a good deal; sucked fists, tongue and nipple, getting air into his stomach during practically all waking hours. Inspection showed a thin, eager baby, sucking fingers, fists or tongue as hard as he could.

His stomach was dilated, the outline being easily made out, the lower edge of greater curvature reaching about ¾ inch below the line of the umbilicus. Wave motion was quite visible and somewhat exaggerated; much tympany of stomach, little of intestine. He was at that time losing nearly all his food, and was very pale and very fretful.

He was at once put on a weak raw milk formula to be fed at regular and absolutely fixed intervals. His arms were splinted to keep his hands from his mouth, and directions were given to break up the tongue sucking.

Directions also were given to posture the child in such a way as to render the greatest assistance to gravity in keeping the fluid content of the stomach at the pyloric end. Massage of the abdomen was explained, and has been persisted in. The baby was carefully observed, and my partner, Dr. Woods, is sure that, at times of greatest activity in vomiting, there was a distinct spasm of the diaphragm, which seemed to add velocity to the expelled stomach contents. Vomiting was of the projectile type, indicating, of course, a quick and strong spasm of the stomach walls, as well as the added pressure of the diaphragm in spasm. Often there was considerable gas or air expelled at time of vomiting.

At present the lower outline of the stomach is about ½ inch above the line of the umbilicus, and the baby is keeping down most of its feedings. He is gaining in weight, weighing 9 pounds 10 ounces on

May 7, and his color and strength are rapidly increasing. His formula has been increased in amount and strength from time to time, and he is now taking about 2 per cent. of fat and 1.7 per cent. protein.

ADDENDA

The child was seen, but not examined, on May 23. He then weighed 10 pounds 12 ounces, and was of good color and normally strong. His mother reported that she could no longer see the outline of his stomach, and that he had retained seventy-six meals without any regurgitation. His formula now is, fat 2.3 per cent., protein 1.8 per cent.

The "posture" was that resulting from putting him on his right side, legs and hips up, head and shoulders a little down, and we had him turned about 45 degrees beyond the vertical axis as he lay on his side.

A remarkable thing is that his sister, now about 3 years of age, was also a cribber, but was quickly broken of the habit.

Besides the food, he was given an occasional dose of strontium bromid, has had phosphorated oil in cod liver oil, and all the time has had an abundance of fresh air and all the sun we have had.

Attention is again called to posture, prevention of unnatural sucking, massage, properly modified food, absolute regularity of feeding.

DISCUSSION

DR. HERRMAN: I would like to recommend the use of atropin in cases of this kind. My colleague, Dr. Haas, has been using atropin extensively in cases of this type and the results are sometimes very favorable.

DR. COWIE: Cases of aerophagia in older children are sometimes difficult to handle. We have recently seen a marked case in the clinic in a child 3 years old following an attack of ileocolitis. We succeeded in overcoming the habit by tying a spool between the jaws after the fashion of a gag. This prevented swallowing or made it so difficult that while the gag remained in all symptoms of distention and abdominal distress were relieved. After two weeks' treatment the patient was completely cured of the habit.

DR. ADAMS: Why do you call this cribbing?

DR. EATON: Because the child bites and chews on anything that comes near it, just as a horse bites and chews at its stall. In this case there was no question of pylorospasm or of general spasm. The child's stomach often got so full of air that he could not get anything else into it. I regret that I was not able to see it at the last visit, but the child was sleeping and we did not think it best to disturb it. The case has responded well to treatment and the mother has carried out instructions.

DR. KERLEY: Did this baby vomit when its mouth was independent of contact with any object?

DR. EATON: It vomited independently of biting and sucking.

A CASE OF INTUSSUSCEPTION

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CHICAGO

This case is reported to record an observation that was made in the fluoroscopic examination of the lower bowel, which revealed a picture of diagnostic value that is not dwelt on in the literature of intussusception.

A 2 year old boy was taken sick one morning with a sudden attack of abdominal pain accompanied by vomiting. During the day he had periods of restlessness occurring every ten to thirty minutes, and between these spells he was drowsy and usually fell into a light sleep. He was given a normal saline enema which emptied the lower bowel of a small amount of fecal matter followed by a discharge of blood stained mucus. During the day he had many passages of bloody mucus. He was seen about five hours after the onset of the illness, asleep in his bed, breathing quietly, with no appearance of shock or pain; pulse 110 and temperature 100 F.

Physical examination was negative, except that there was felt in the right upper quadrant of the abdomen a soft tumor mass about 2 by 3 inches with its long axis transverse. Rectal examination detected nothing except that following the withdrawal of the examining finger there was an escape of about an ounce of very bloody mucus.

The boy was taken to St. Luke's Hospital and seen in consultation by Dr. L. L. McArthur, who suggested a fluoroscopic examination of the lower bowel.

The boy was placed prone on the table in the roentgen ray dark room and an enema of barium buttermilk from a height of 18 inches was given. The barium was observed through the screen entering the bowel, filling it from below upward until the mass reached the middle of the transverse colon. Here the column of barium halted for a moment and then a small stream of barium trickled from the heavy column along the periphery of the colon for a distance of about an inch, and after this the column did not advance or alter its appearance.

The arrested barium column then looked like a solid mass with a very decided concave or U-shaped termination.

The boy was operated on immediately by Dr. McArthur, who found an ileocolic intussusception about 3 inches long, which he reduced, and also removed a long appendix that had been engaged in the tumor mass. Recovery was prompt.

The illustration (Fig. 1), taken from Pfaundler and Schlossman's textbook, will show what the appearance of an opaque enema would be if observed under the screen.

In Figure 2 is shown the involuted small bowel, known as the intussusceptum, wedged into the colon, the intussuscipiens, and

Fig. 1.—Appearance of opaque enema.

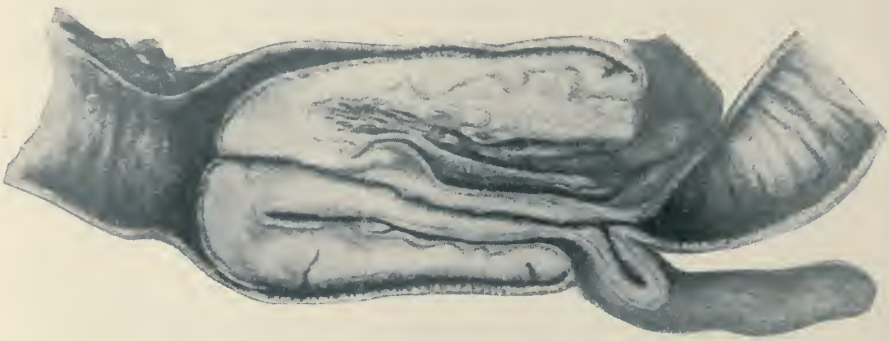

Fig. 2.—Illustration from Pfaundler.

because of the constriction of the mesentery, the inner and middle layers of the bowels are congested and swollen, completely obstructing the lumen of the bowel, but the outer and middle layers of the intussusception are not so closely approximated; in fact, in the illustration there is a very decided interval between these layers.

If a barium or bismuth enema were observed under the screen, on a case of intussusception, the mass would be seen filling up the bowel until it was arrested by the intussusceptum and a small amount of the mass would pass for a longer or shorter distance between the intussusceptum and the intussusceptiens, and the shadow made by the thin layer would be so appreciably different from that made by the dense mass that the end of the column would appear to be concave or U-shaped (Fig. 2).

Such an observation would not occur in any other condition of the bowel, and this sign is presented as of value in the diagnosis of intussusception.

DISCUSSION

DR. MORSE: If Dr. Wall will look through the literature he will find a description by William E. Ladd published the winter before the American Medical Association met in Minneapolis (1913). I recall it because I referred to it in a paper I read there.

DR. PORTER: If it is true that it is a good procedure to use the roentgen ray, would it not be well to use a column of barium suspension, the original Hirschsprung technic, and to replace the intussusception while observing the reduction under the fluoroscope? In this method extensively used by the Danes, high hydrostatic pressure and manipulation with the hips well raised are used and found to be effective in reducing the intussusception. On one of our patients we used a similar method, and to see what was happening we had the abdomen opened and observed the reduction taking place. This child had had the intussusception for several days and was in bad shape. We did not drag on the intussusception but depended on the hydrostatic pressure to untangle the intestine, and it was easy to make sure of reduction, for that process took place in full sight of the operator. I believe this is a very valuable method of dealing with the older cases of intussusception. But it may possibly be well to use the hydrostatic reduction method, using the barium enema and putting the child under the fluoroscopic screen while reduction is going on, more to follow the untangling and to see if the intussusception can not be reduced in this way without opening the abdomen. So far as I know, this procedure has not been attempted.

DR. HAND: There are those who think the diagnosis of intussusception is very easy, but this is not always the case. I had a case in a child 19 months of age who was seized with vomiting, constipation and colic, which was followed by blood and mucus in the stools. There was boardlike rigidity on the lower side of the scrotum. A surgeon was called in who found a strangulated hernia. The condition had existed for twenty-four hours. The hernia was easily replaced. Had it not been for the fact that the mass was palpated in

this instance the symptoms would have seemed very much like those of intussusception.

DR. SHERMAN: I showed some pictures at the meeting of the New York State Medical Society last week and one of them was subacute intussusception, the same state which has been described. There was a very narrow lumen through the intussusception. The condition was subacute and operation was advised. This the mother refused and the interesting feature in this case was that the child passed part of the bowel in about a week or ten days after it left the hospital. The child has since progressed normally.

DR. WALLS: We believe that the observations made in these pictures are of great value. We looked up the literature, but did not see the article by Ladd, and are glad the observation has been made and is of value, as we believe it to be. Richter has done considerable work on animals, and especially on dogs, but we find no reference to anything that would indicate that he has shown the overlapping. As Dr. Porter suggests, this observation may be of great value in reducing an intussusception under the fluoroscopic screen, perhaps with the child under an anesthetic. The plan Dr. Porter suggests is at least worth trying.

NEUROBLASTOMA SYMPATHICUM

REPORT OF A CASE, WITH NOTES ON TWO OTHERS, AND A BRIEF REVIEW OF THE LITERATURE *

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AND
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CASE 1.—Charles C., 4 years and 3 months old, was admitted to the Children's Hospital, Dec. 31, 1917. His family history was good. He was born at full term, and had always been well, except for rather frequent "colds" during his infancy. His mother thought that his abdomen had always been large, but she had not noticed it especially until two weeks before, since when it had increased in size very rapidly. He began to fail rapidly about the same time and the last week had been confined to bed. Since being in bed he had been somewhat short of breath and had had an unproductive cough. His appetite was fair, he did not vomit and his bowels were regular. He had no symptoms pointing to trouble in the urinary tract.

Physical Examination.—He was pale and poorly developed, and showed some evidences of old rickets. His tongue was slightly coated. The throat, heart and lungs were normal. The abdomen was markedly distended and the superficial veins slightly enlarged. The lower border of the liver was palpable, hard and sharp, 6 cm. below the costal border in the right nipple line, 8 cm. below the ensiform and running under the left costal border in the anterior axillary line. The surface was smooth, hard and slightly tender. The spleen was not made out. The kidneys were not palpable and there was no unusual resistance in the flanks. There were no evidences of free fluid in the abdomen. The genitals were normal and the rectal examination was negative. There was slight edema of the legs. There were no evidences of any involvement of the nervous system.

The urine was acid and cloudy from urates, but contained no albumin or sugar. The sediment was negative.

The blood showed: hemoglobin, 60 per cent. (Sahli); red corpuscles, 2,000,000; white corpuscles, 5,500; mononuclears, 40 per cent.; transitionals, 4 per cent., and polynuclear neutrophils, 56 per cent.

The red corpuscles showed slight achromia, but no variation in size or shape.

The tuberculin test was negative to both the human and bovine types.

The Wassermann test was negative.

The liver increased very rapidly in size, and edema of the scrotum, back and legs became marked. He lost very rapidly in weight and strength and died Jan. 6, 1918, one week after his admission and three weeks after the symptoms were first noted.

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* From the Children's Hospital.

The diagnosis during life was sarcoma of the liver, which, in spite of the rarity of the condition, was thought to be primary rather than secondary, because no primary focus of disease could be found elsewhere.

Necropsy.—A restricted necropsy was performed by Dr. S. B. Wolbach, fifteen and a half hours after death. The head was not opened. The throat, heart, lungs, gastro-intestinal tract, pancreas and pelvic organs showed nothing abnormal. The peritoneal surfaces were smooth and glistening. The mesenteric lymph nodes were not enlarged.

Liver: The lower border of the liver extended down to the crest of the right ilium and in the median line was 14 cm. from the ensiform. The enlargement of the liver was almost symmetrical. The suspensory ligament was pushed over to the left owing to the great enlargement of the right half of

Fig. 1.—Photograph of a section of a Kaiserling specimen of the liver, Case 1. The scale is in inches.

the liver and the anterior border of the right lobe was deeply notched a few centimeters to the right of the median line of the body. The liver weighed 2,050 gm. The capsule was smooth. The color was pale red and reddish yellow, mottled with fatty, opaque areas which were not elevated above the surface. These areas varied in size from 1 mm. to 1 cm. in diameter. The liver was extremely friable. Section showed surfaces bearing very little resemblance to normal liver tissue (Fig. 1). As a whole, the cut surfaces had a translucent appearance. There were distinct areas of translucent white tissue, circular in shape, all produced by the confluence of circular areas, thickly distributed throughout the whole of the liver. There were other large areas 4 to 15 mm. in diameter which were soft, deep red and bulging slightly from

the cut surfaces. Here and there were narrow bands and small areas of brownish liver tissue, but everywhere paler than normal. It was quite evident that the whole of the liver was infiltrated with a soft new growth.

The gallbladder and bile passages were patent and normal. Accompanying the cystic duct was a lymph node, 8 by 4 mm., which was soft, translucent white.

Spleen: The spleen was enlarged and measured 10 by 6 cm. The capsule was smooth; the color, salmon red. On section the cut surfaces were everywhere smooth and normal in appearance, except for a slightly paler color than is normal. The splenic corpuscles were visible and appeared normal.

Kidneys and Adrenal Glands: The kidneys were normal in size, color, markings and consistency. Partly overlying the left kidney and extending to the median line was a tumor mass (Fig. 2). The kidney itself was not con-

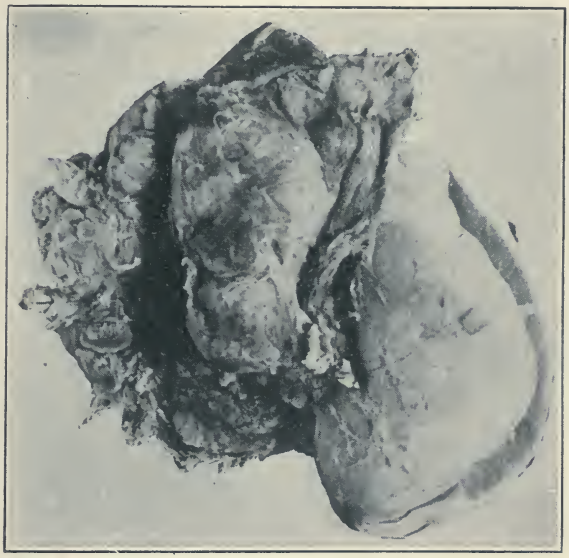


Fig. 2.—Photograph of the primary tumor of the adrenal and the kidney, Case 1.

nected with this tumor growth. Section of the tumor mass revealed its intimate relation with the adrenal gland. The tumor mass, as a whole, including the adrenal gland, was 8 cm. in length and 4 to 5 cm. in width. The superior end of the adrenal gland was recognizable. There was a triangular piece of adrenal present which measured 2.5 by 2.5 cm. Extending downward behind the tumor mass was a band of adrenal cortex, 4 cm. in length and from 6 to 8 mm. in width. This arm of the adrenal was not adherent to the tumor mass as a whole. In the center of the triangular portion of the adrenal gland first mentioned, was an elevated, white tumor nodule 8 mm. in diameter. Beneath this there bulged from the substance of the adrenal a tumor mass, 5 cm. in length, composed of three nodules, the superior one, 1 cm. in diameter, the middle one 3 cm., the inferior 2 cm. A section through the adrenal

showed that the first mentioned tumor nodule extended into the substance of the adrenal and a cut section showed irregular borders. The color was grayish white. Beneath that there was a nodule, 1 cm. in diameter, soft and dark red. Section of the largest nodule, which was 3 cm. in length, presented in part firm white friable tissue, in part dark red necrotic material with many small gritty areas. The inferior nodule composing the main tumor mass was dark red, soft, and apparently composed of necrotic tumor tissue. There were numerous large lymph nodes lying between this tumor mass and the median line and grouped around the celiac axis. These lymph nodes varied in size

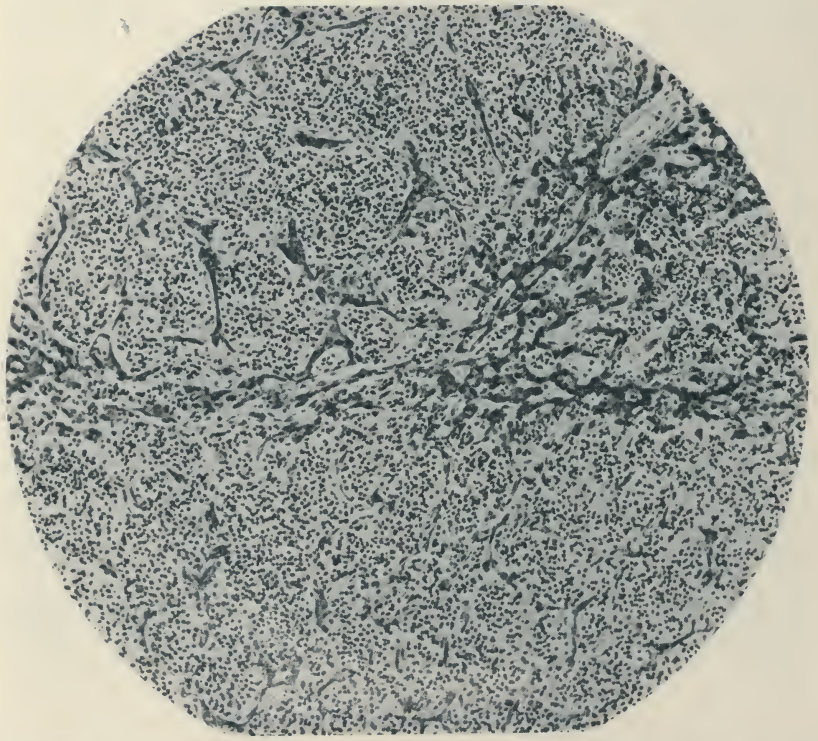


Fig. 3.—Low power photomicrograph of a section of the liver, Case 1; about 125 diameters.

from 3 to 8 mm. On section they were soft, translucent and white. The right adrenal gland was normal.

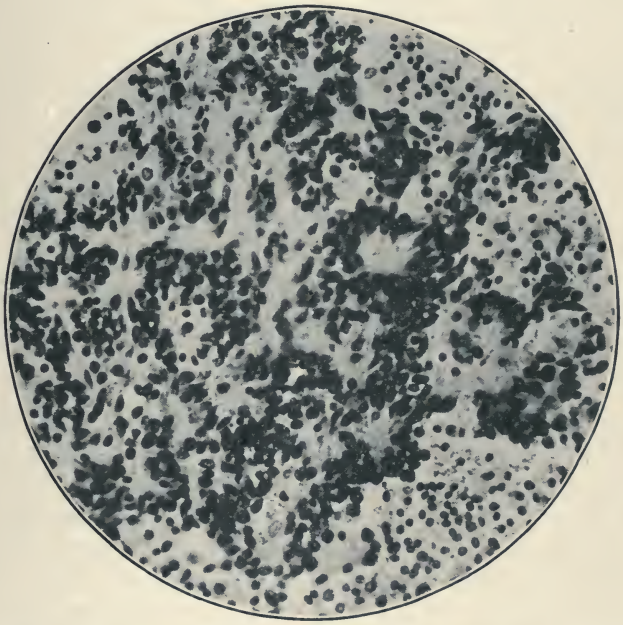
Frozen Section of Tumor: Frozen sections of the tumor, after hardening in formaldehyd solution, showed in the liver almost complete replacement of the liver parenchyma by small round cells with deeply stained nuclei. In some places the destruction of the liver tissue was complete, in others the liver columns could be recognized much flattened and distorted.

Sections of the tumor of the adrenal showed a small round cell tumor with a delicate reticular framework. Portions of this tumor were necrotic

and portions were fibrous, but other portions showed a rosette grouping of the cells surrounding a central granular or fibrillar mass, characteristic of ganglioma embryonale sympathicum or neuroblastoma sympathicum.

Microscopic Examination. — The tissues were fixed in Zeuber's fluid and stained with eosin-methylene blue.

Liver: There is very little liver tissue remaining. The organ was largely replaced by a new growth consisting of exceedingly minute cells, smaller than lymphoid cells, most of them with densely staining homogeneous nuclei, having the appearance of pyknotic or postmortem nuclei. This appearance of the nuclei is probably due to richness in chromatin, as the preservation of other cells, that is, liver cells and bile ducts, is perfect (Fig. 3). The liver tissue



4. Photomicrograph of the primary tumor of the adrenal gland, Case 1; about 400 diameters.

is present in the form of anastomosing strands, in which the liver cells are usually much distorted, but occasionally they are almost normal in appearance. The intervening tissue filled with the tumor is traversed with delicate epithelial tubules, which probably represent regenerated bile ducts. In other places, where the tumor is actively invading, there are all degrees of atrophy and degeneration of the liver cells, and it is possible to see that the tumor cells are growing between the liver columns and endothelium of the sinusoids, although in most places such details of structure are entirely obliterated. The tumor cells are small, the cytoplasm is extremely scanty in amount and difficult to demonstrate. There are occasional clusters of slightly larger cells with nuclei less densely stained and containing scattered particles of chromatin.

The cells, however, are embedded in a finely granular material, which in places can be seen to have a linear striated effect suggestive of protoplasmic fibrils. In some portions of the liver the replacement by tumor cells is so complete as to obliterate all trace of liver. There are many mitotic figures among the tumor cells.

Adrenal Gland: Sections through the adrenal gland containing the primary tumor showed the bulk of the tissue to be composed of minute cells similar to those in the liver metastasis. There are places, however, where there is a very perfect "rosette" formation, consisting of larger cylindrical and pyriform cells arranged about a central mass of granular material (Fig. 4). This central granular material can be resolved in places into very delicate fibrils and the latter in some instances can be traced into the pyriform tumor cells. The stroma consists of a delicate vascular fibrous tissue. The tumor is a rapidly growing neuroblastoma, of sympathetic ganglion cell origin.

Lymph Node: Sections of a lymph node adjacent to the tumor mass showed complete replacement by the exceedingly minute type of tumor cells.

Celiac Ganglia: These are almost completely replaced by the tumor cells, which are always of the very small type.

Spleen: The malpighian bodies are of normal size and shape. A few contain hyaline masses and reticular hyaline material. The pulp contains many eosinophils of the myeloid type. The venules contain groups of cells which are possibly tumor cells, since many of them were smaller than lymphocytes and have deeply stained nuclei.

Kidneys and Right Adrenal Gland: These were normal.

DISCUSSION

From the liver alone the diagnosis of neuroblastoma would have been impossible to prove, although warrantable, as numerous instances are recalled in which the cells in the metastases from neuroblastomata primary in the adrenals have had the appearances characteristic of this case. The diagnosis in this case is established by the presence of the tumor in the adrenal showing a greater degree of differentiation of the cells evidenced by the formation of protoplasmic fibrils and the arrangement into ball masses which in section produce the rosette appearance.

The essential element in the tumor for diagnosis is the fibrils. The fibrils are not to be compared with the coarser, more or less specifically staining fibrils associated with connective tissue and neurogalia cells. They are in reality delicate protoplasmic processes and are representative of axis cylinder processes. There is no special stain for their demonstration.

The earliest diagnosis based on the presence of these fibrils in malignant tumors of the adrenal gland was that of glioma. Virchow[1] and

1. Virchow: Die Krankhaften Geschwulste, Berlin, 1863-1865.

Marchand[2], in 1891, recognized the nervous character of a tumor of the adrenal and compared the cells with the neuroblasts of the fetal sympathetic ganglia.

J. H. Wright[3], in 1910, focused attention to this group of tumors and collected twelve cases, including four of his own. He briefly and succinctly showed that the tumor cells associated with the fibrils have the "same morphology as the cells from which the sympathetic nervous system and the medulla of the adrenal develop and which are regarded by embryologists as arising from migrated primitive nerve cells." Wright offered the names neurocystoma and neuroblastoma as equally applicable.

Pick and Bielschowsky[4], in 1911, in a classification of tumors of nerve tissue origin, gave the name ganglioma embryonale sympathicum to the tumors described by Wright. Pick[5], in 1912, collected a total of eighteen cases, including one of his own, and discussed fully and adequately the origin and the relationship of the tumors arising from the primitive nerve cells. These tumors may represent any of the potentialities of the primitive cells, which are nerve cells, glia cells and chromaffin cells. The tumors representing nerve cells with which we are now dealing may be either rapidly growing and undifferentiated or more slowly growing and more highly differentiated into ganglion cells. He completely substantiated Wright's conclusions.

Landau,[6] independently of Pick, in the same year, published a similar classification and discussion of these tumors. He added three cases of his own and uses the name malignant sympathetic neuroblastoma. From this time on the origin and classification of these tumors has been accepted and numerous new cases have been added.

The paper of Herxheimer,[7] in 1913, covers substantially the same ground as those of Pick and Landau. He chooses Landau's name, neuroblastoma sympathicum, in preference to Pick's ganglioma embryonale sympathicum, a choice which has proved to be in accordance with the preference of subsequent writers.

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2. Marchand: Festschr. f. R. Virchow; Internat. Beitr. z. wissensch. Med., Berlin, 1891, 578.
3. Wright, J. H.: Jour. Exper. Med., **12,** 556.
4. Pick and Bielschowsky: Ztschr. f. d. ges. Neurol. u. Psychiat., **6,** 391.
5. Pick: Berl. klin Wchnschr., **49,** 16.
6. Landau: Frankfurter Ztschr. f. Path., **11,** 26.
7. Herxheimer: Beitr. z. path. Anat. u. Path., **57,** 112.

Two American papers, each introducing a new case, by Wahl[8] and Lehman,[9] are comprehensive and adequate to orient any one desiring more information on the subject of neuroblastoma. Lehman has collected a total of twenty-five cases of sympathetic neuroblastomas and several doubtful cases.

Hertz and Secher's[10] case is the most recent one recorded and in the rapid growth of the liver metastasis bears some resemblance to our case.

Our case is noteworthy for the rapidity of the growth of the liver metastases, which overshadowed all other signs, and the absence of apparent metastases elsewhere. As a complete necropsy was not permitted, early metastases to the bones can not be excluded. It is our opinion that these tumors are not as rare as the small number of published cases would indicate and for this reason we append the reports of two other cases from the surgical service of the Boston Children's Hospital.

CASE 2.—W. D. MacN., aged 7 months, was admitted June 12, 1917. His past history and family history are irrelevant. May 4 a physician noticed a mass in the right side of the abdomen which was not tender and which did not noticeably increase in size. The physical examination showed a well nourished infant. The skin, eyes, ears, nose, mouth and throat were all negative. The heart and lungs were normal. The reflexes were normal. The abdomen showed a bulging in the right upper quadrant. Palpation showed a hard irregularly shaped mass occupying the whole of the upper and a third of the lower right quadrant. It was not tender. It descended with respiration, was not attached to the abdominal wall and by rectal examination the lower end was found to be freely movable.

An exploratory operation was done on June 14. The tumor was found to be inoperable and a small piece was removed for microscopic examination. The abdomen contained a slight excess of fluid in the flanks. The tumor was hard, nodular and not cystic and extended from the right costovertebral angle to below the brim of the pelvis and inward beyond the median line. It overlay the aorta and vena cava. The ascending colon was displaced forward and inward and crossed vertically the median aspect of the tumor.

Death occurred seven hours after the operation. Permission for a necropsy was refused.

The material was fixed in Zenker's fluid and stained with eosin-methylene blue, Mallory's phosphotungstic acid hematoxylin, Van Gieson's stain and hematoxylin and eosin. The photomicrographs were made from sections stained with hematoxylin and eosin.

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8. Wahl: Jour. Med. Research, **30,** 205.
9. Lehman: Jour. Med. Research, **36,** 309.
10. Hertz and Secher: Hospitalstidende, **60,** No. 45; abst. Jour. Am. Med. Assn., 1918, **70,** 278.

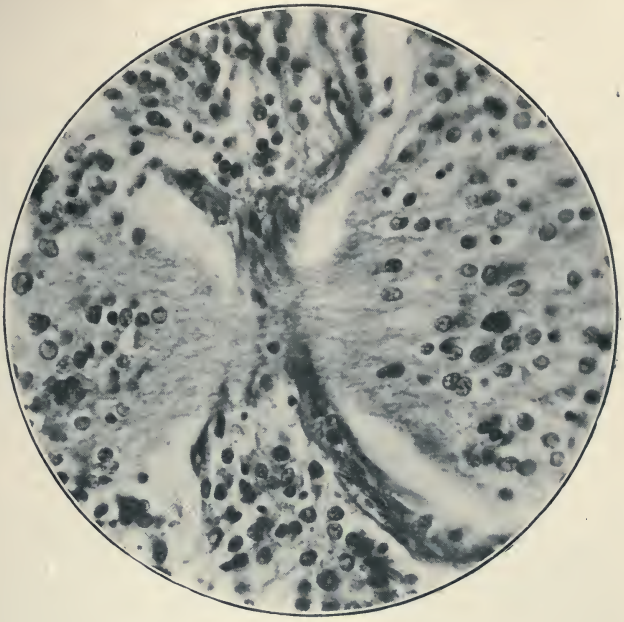

Figure 5

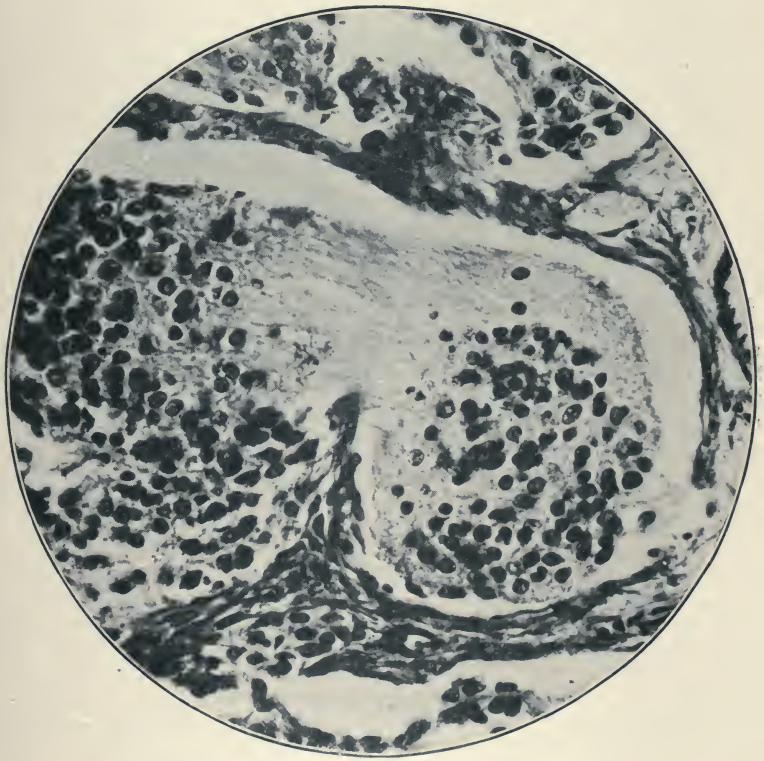

Figure 6

Figs. 5 and 6.—Photomicrographs from Case 2, showing masses of fibrils

Microscopic Examination.—The tumor is composed mainly of small round cells irregularly arranged in masses which are separated by a delicate fibrous tissue stroma giving an alveolar appearance. The tumor cells vary in size and the nuclei contain a variable but large amount of chromatin. The cytoplasm is small in amount and usually difficult to demonstrate. There are groups of larger elongated cells in compact masses but there is no rosette grouping in the sections. Delicate fibrils are very numerous throughout the tumor between individual cells and in large masses of parallelly arranged wavy fibrils lying between the groups of tumor cells and stroma or extending between adjacent clumps of tumor cells. There are many mitotic figures and a rare type of larger cell with abundant cytoplasm suggesting a ganglion cell. The tumor is a typical malignant neuroblastoma sympathicum identical with many of the reported cases (Figs. 5 and 6).

CASE 3.—Myrtle P., aged 2 years and 2 months, was admitted to the outpatient department, March 2, 1918, for swelling and tenderness at the left knee, attributed to a fall one week previously. The knee was swollen, not red, slightly tender. There was limitation of motion to 20 degrees extension and 60 degrees flexion. A roentgenogram made March 5 shows widening of the lower end of the diaphysis of the femur with areas of rarefication just above the epiphyseal line. A mass was noticed in the abdomen and the child was admitted to the hospital March 9.

Her past history and family history are irrelevant. The child was well nourished and well developed. The cranium, eyes, ears, nose, teeth, mouth and throat were negative. The heart and lungs were normal. The reflexes and skin were normal. The extremities with the exception of the left knee were normal. The abdomen was rounded and tympanitic, with the exception of the left upper and middle quadrants. In the left upper quadrant there was felt a hard rounded mass which did not move when the position of the child was shifted. It was smooth, not tender.

An operation, March 11, showed a large tumor of the left kidney. This was enucleated and found to be adherent posteriorly. It extended upward to the diaphragm, where there was a cyst. The cyst ruptured and a considerable quantity of brown semisolid material escaped. After removal of the tumor there was but little bleeding from the cavity, but inspection showed that there were nodules of the growth extending downward along the vertebral column and out into the broad ligament on the left side.

Death occurred March 28, presumably hastened by a low grade infection of the peritoneum.

Pathologic Report.—The specimen consisted of a kidney partly replaced by tumor. It was moderately firm and measured 13 by 7 by 5 cm. The lower pole was evenly rounded. At the upper pole there was a loss of substance involving the pelvic border of the kidney, about 3.5 cm. in diameter. There was in this location an irregularly circular yellow and red mottled crater, the base of which was formed of granular friable material. At the periphery of this crater there was attached a grayish membrane continuous with the capsule of the kidney and which probably was the remains of the capsule overlying the necrotic mass. A section through this pole of the kidney showed an irregular zone of yellowish red mottled tissue, 1 to 2 cm. deep, and inferior to this the kidney substance appeared to be normal.

Microscopic Examination.—The tissue was fixed in Zenker's fluid and 10 per cent. formaldehyd. The description is based on sections stained with eosin-methylene blue, Van Gieson's stain and Mallory's phosphotungstic acid hema-

toxylin stain. The photomicrographs were made from sections stained with hematoxylin and eosin.

Sections through the upper pole of the kidney show a new growth consisting of large anastomosing columns of tumor cells with many mitoses and supported by a delicate connective tissue stroma. Most of the tumor cells are small and round. In many places there are elongated oval and pyriform-shaped cells. The latter have a finely granular cytoplasm which can often be traced out into long delicate processes. The nuclei are relatively large, vesicular in type and contain a large amount of chromatin in the form of a

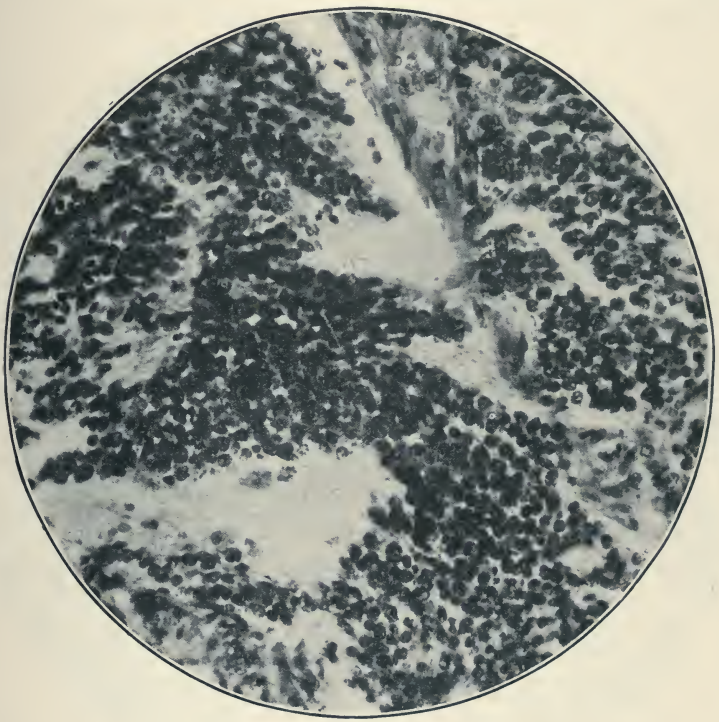

Fig. 7.—Photomicrograph, Case 3, showing bundles of fibrils between masses of the tumor cells and between the tumor and the stroma; about 400 diameters.

coarse network (Fig. 8). The amount of cytoplasm is very scanty and as a rule is eccentrically situated in relation to the nucleus. The size of the cells is slightly larger than the size of lymphocytes found in the germinal centers of lymphoid follicles. Here and there throughout the tumor there are very delicate fibrils occurring in small bundles between the tumor cells and extending between adjacent clumps of tumor cells (Fig. 7). These fibrils are also found in bundles of considerable size lying between the connective tissue stroma and the tumor cells. The fibrils are exceedingly delicate and have a granular structure and bear no resemblance to the deeply staining intercellular

fibrils of connective tissue and neuroglia (Fig. 8). There is no rosette formation but the diagnosis of neuroblastoma sympathicum is established beyond question by the presence of the delicate nerve fibrils.

No postmortem was obtained and therefore the location of the primary tumor cannot be proved. The extensive loss of substance and invasion of the kidney at the upper pole indicate, however, that the tumor took origin from the adrenal gland.

These three cases present the slight differences in the histology exhibited by this type of tumor. In the first case we have rosette formation in the primary tumor and in the metastases extreme rapidity

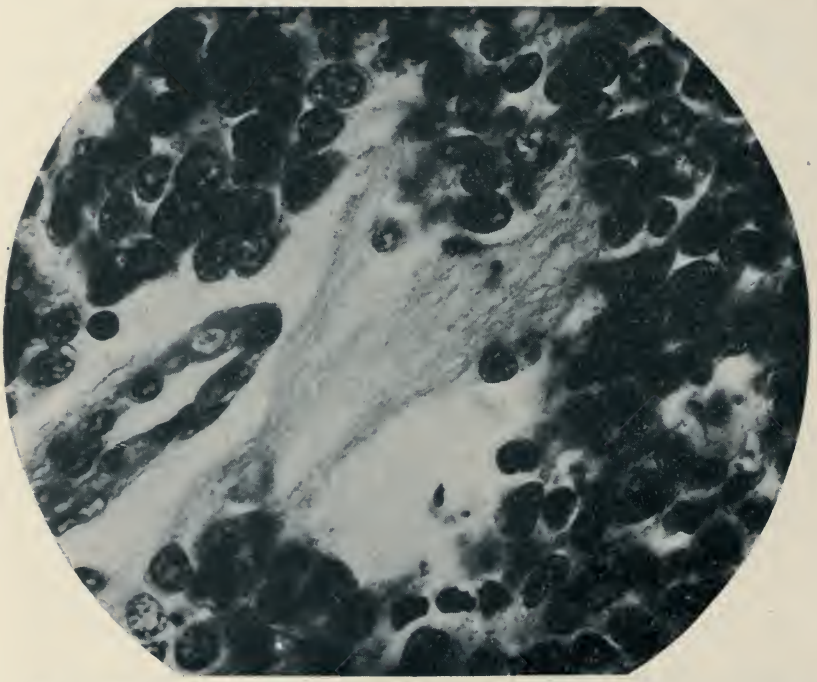

Fig. 8.—Higher power photomicrograph of a section from Case 3, showing the character of the nuclei and the fibrils; about 800 diameters.

of growth without rosette formation or fibril formation. The density of the nuclei is indicative of a large chromatin content and rapidity of growth, as has been noted by other authors. In the second and third cases no rosette formation was found. Fibril formation was abundant in the second case, less abundant in the third, which represents a type easily overlooked. These three cases bring the number of undoubted

cases of neuroblastoma sympathicum to twenty-nine, of which twenty were primary in the adrenal gland. The others have taken origin in sympathetic ganglia (three), retroperitoneal tissues (three), coccygeal gland, nose and uterus. It is highly probable that many other cases of primary tumors of the adrenal gland reported as sarcomas were neuroblastomas, as, for instance, the fourteen cases of adrenal tumors with cranial metastases collected by Tileston and Wolbach.[11] Of all the cases reported, but one patient survived, Lehman's case,[9] the only successful operative removal of a tumor of this type in an infant.

Since a variety of terms have been used to designate the malignant tumors representing a primitive type of sympathetic ganglion cells, it seems advisable to indicate a choice. Wright's terms neurocytoma and neuroblastoma are too inclusive. Ganglioma embryonale sympathicum, introduced by Pick and Bielschowsky, has been regarded by several authors as unsatisfactory because of the employment of ganglioma by others to designate a more highly differentiated type of nerve cell tumor. Our own preference is for the term neuroblastoma sympathicum or sympathetic neuroblastoma.

REFERENCES

For the complete bibliography of this and related types of tumors the articles of Pick and Bielschowsky, Pick, Herxheimer, Wahl and Lehman should be consulted. The presentation of cases in the literature in tabular form by Wahl and by Lehman makes their papers particularly useful.

DISCUSSION

DR. RICHARD M. SMITH: I would like to record two cases that occurred at the Massachusetts General Hospital. Both of these cases were seen within two weeks of each other. The first case was very confusing. It presented a history of rapid increase in the size of the abdomen, with a hard, movable tumor in the median line between the ensiform cartilage and the umbilicus. There were various guesses as to what the condition might be. The mass did not feel like the left lobe of the liver and it did not feel like the kidney. We were uncertain whether it was a retroperitoneal tumor or enlarged gland. The diagnosis of neuroblastoma was made on operation after excision of a small portion of the tumor. Subsequently the child died. The second case presented a very similar history. The abdomen was opened, but nothing was done.

I would like to ask about the other adrenal in Dr. Morse's case. We have often a bilateral involvement of the adrenals.

DR. MORSE: In reply to the question whether both adrenals were involved, one was perfectly normal.

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11. Tileston and Wolbach: Am. Jour. Med. Sc., June, 1908.

DR. EATON: One week ago I saw a case that matched this one. The child was seen by a colleague four weeks previously. This child was a Russian Jew. The older sister was quite normal and the child had a nice looking baby brother. The patient was 21 months of age and had been sick for six weeks. There was a mass in the abdomen which came down below the line of the umbilicus. The abdomen was very much distended and the spleen was not palpable. We thought it was possibly a sarcoma of the kidney or liver. The child looked very much distressed and was very anemic, and we could not hold out any hope for it. I tried to arrange with my colleague for a post-mortem. The picture was very similar to that which Dr. Morse has reported.

CURE OF A SYPHILITIC MENINGITIS BY ARSPHENAMIN AND MERCURY

SYMPTOMS—CONVULSIONS AND INTENSE OPTIC NEURITIS—DEVELOPED AFTER A HEAD INJURY

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The writer presents the history of a case of luetic meningitis in a child. The condition, although not unusual, has received scant attention in pediatric literature.

REPORT OF CASE

History.—The child was well up to March 1, 1917, when he fell from the roof of a standing freight car, striking on his head. After the accident he seemed in great pain for several hours. During the night he had a chill and vomited until morning.

Two weeks later he commenced to have crying attacks and twitching and pain in the left arm.

These emotional attacks increased in severity and were associated with convulsions, which occurred every second night.

Four months after the injury (July 10) the patient entered the Buffalo General Hospital as a case of epilepsy. During the first ten days of his stay he had one convulsion, frequent screaming attacks and periods of maniacal excitement. He cried, swore and talked incoherently, and complained of pain and muscular twitching in his left arm. After a few days it was noticed that his movements were awkward and constrained; that he held his head and back very rigidly, the head being inclined to the right.

Examination, July 20.—He was a well developed boy of 10 years. The neck was very stiff and difficult to bend backward; no tenderness of the skull or neck; spine normal in contour but restricted in motion and very rigid; tenderness and muscle spasm along the vertebrae and in the right flank. A roentgenogram showed the cervical and dorsal spine to be free from disease The knee jerks were very active; ankle clonus of right leg; Kernig sign present, most marked on right side; muscles of arms and legs very spastic. The pupils were widely dilated; reacted to accommodation but not to light. There was a double optic neuritis of 2 diopters, each side. Leukocytes, 9,350; hemoglobin, 80 to 90 per cent.

By lumbar puncture 10 c.c. of fluid were obtained under moderate pressure; it was colorless, turbid and contained 466 cells per cubic millimeter. Globulin and albumin were each ++++; Wassermann, ++++. The father and mother each showed a Wassermann ++.

Diagnosis and Treatment.—The child was evidently suffering from a syphilitic cerebrospinal meningitis. He was given daily inunctions of mercury and arsphenamin every one or two weeks.

After the first dose of arsphenamin there was a prolonged chill and fever of 102 F., the only rise of temperature in the disease.

Course.—August 5. There were several screaming attacks and one long convulsion.

August 6. Swelling of the optic disks was much increased; most marked on the right side. The child said he could not see. There were severe root pains in left leg, right hip and shoulder.

August 10 to 26. During the next two weeks the child grew steadily worse. The screaming attacks and convulsions were very frequent. One day the child had four convulsions. He complained continually of root pain in his arms, legs and back. His mental condition was much disturbed. The child scarcely spoke at all; was slow of comprehension, disobedient, hard to control, executed simple orders slowly and with difficulty; often struck the other children in the ward.

The neck and back were very stiff. It was almost impossible to elicit lateral and backward movement.

Choking of the disk was very marked; right 4 D.; left 3 D., indicating increased intracranial pressure.

Spinal puncture gave 25 c.c. of fluid under pressure; very cloudy. Globulin and albumin were ++++. The cell count was 1,700 (contrast with five weeks before: cell count 466), showing an increase in the meningitis.

August 27. No convulsions; severe root pains in the arm. The oculist stated that the optic neuritis was increasing and gave a bad prognosis as to vision.

September 3 to 6. There had been crying attacks and convulsions. Note that in the previous two weeks the convulsions almost ceased, but a steady increase in intracranial pressure was shown by the condition of the optic disks.

Two lumbar punctures gave no relief, and September 8, the oculist gave a last urgent warning that the swelling in each disk was 6 D., indicating dangerous intracranial pressure, and that blinding was imminent unless a decompression was made.

September 8. Decompression and aspiration of the right ventricle; 50 c.c. of fluid withdrawn. During the next ten days the child vomited frequently, was restless and screamed a great deal; no convulsions. The swelling of the optic disks subsided to 4 D., then increased to 6 or 7 D.

September 21. The right ventricle was aspirated; 15 c.c. of phenolsulphonephthalein solution were injected into the ventricle. Two hours afterward phenolsulphonephthalein was found in urine; two and a half hours afterward no phenolsulphonephthalein found in spinal fluid.

After the aspiration the boy was very restless for forty-eight hours and had a long convulsion, relieved by chloral. The optic disks were daily examined, but the aspiration produced absolutely no improvement. After two weeks a slow reduction in the swelling occurred. A month later the swelling amounted to 2 D.

There were no convulsions or mental disturbance after September 24.

October 22. The boy was in very good condition; ate and slept well; was active about the wards and out of doors. The mental dulness had disappeared; understood and obeyed quickly; was able to draw squares and circles, write name and address; was very responsive when given Swedish gymnastics; was mischievous and had to be frequently reproved.

Sensation was everywhere normal; head held to right; slight limitation of movements of head and spine; no local tenderness, neck, skull or back; mouth habitually open; pupils dilated; Kernig's sign present; knee jerk active; no ankle clonus.

Spinal fluid clear; 13 lymphocytes per cubic millimeter. Wassermann and colloidal gold test positive. Wassermann ++++ to 6 c.c.; negative to 0.4 c.c. Lange colloidal gold test = luetic curve, 1.5, 1.5, 2, 1.5, 1.5, 1, 1, 0, 0.

During November and December there was continuous improvement. About December 24, the Wassermann was negative, and the optic neuritis had disappeared. The boy was sent home and attended school regularly. In April he complained of frequent momentary headache. The spinal fluid, however, was negative to the Wassermann and colloidal gold tests. About May 1, the optic disks were normal.

On May 14, fourteen months after the beginning of symptoms, the child was free from all symptoms and had been for seven months.

INTERESTING FEATURES OF THE CASE

1. Neither the parents nor the child had any symptoms of syphilis, hereditary or acquired.

2. The fall on the head acted as a provocative agent causing cerebrospinal symptoms in a case of presumably latent hereditary syphilis. This, of course, is not unusual. Nonne believes that the importance of head injuries as a cause of cerebral syphilis is overestimated, and also says that these accidents do not cause especially severe forms of luetic meningitis; extensive affections of the interior of the brain may remain entirely symptomless. In the development of the brain symptoms of syphilis, nervous heredity or neuropathic constitution has absolutely no influence.

3. The lesion in the cerebrospinal meninges was probably a proliferative gummous leptomeningitis involving the cortex and spinal meninges; also in ependymitis with an increase of cerebrospinal fluid and some hydrocephalus. The choked disks were due to intracranial pressure from fluid and not to a direct inflammation of the optic nerve.

Optic neuritis is present in 40 per cent. of cases of cerebral syphilis. Ophthalmologists tell us that a high grade choked disk is usually a simple edematous saturation and may exist without disturbance of vision or injury to the retina, subsiding under antisyphilitic treatment. If the process is allowed to progress it may cause partial optic atrophy. In this case the course, increase and gravity of the brain symptoms was discovered and controlled by the oculist, Dr. H. W. Cowper. Every case of supposed epilepsy should have the fundus and spinal fluid examined.

Heubner emphasizes the frequency of epileptic convulsions in syphilis; of forty-five cases of gummous meningitis twenty-five patients had convulsions. Contrast the absence of fever with the fluctuating temperature of tuberculous and other meningitides.

4. The decompression and aspiration were followed by no immediate relief save that the lessening of intracranial pressure gave the cerebral circulation a little more freedom.

The patient was very responsive to treatment; the acute symptoms lasted about three months. Mercurial inunctions were given every day for five months and arsphenamin at first every week; later every two weeks.

The cure of syphilitic meningitis even before the days of arsphenamin was not infrequent. Of Nonne's cases of cerebral syphilis only two were between the ages of 1 and 10 and one between 10 and 20. All improved.

The same author using only mercury and iodid reports 71 per cent. of recoveries, acquired and hereditary syphilis having the same prognosis.

In syphilitic meningitis of the convexity, with partial and general epilepsy and alarming and characteristic symptoms, recovery is common. Relief is more certain if specific treatment is used early. Oppenheim and Ehrlich have the impression that in the present era of arsphenamin, cerebral symptoms are more frequent, owing to slight nerve injury rendering the tissue more susceptible to the irritation of syphilis. Oppenheim questions whether the Wassermann test of the blood and spinal fluid is a criterion for the continuance and repetition of therapy. The writer received much assistance in the management and treatment of the case from Dr. H. W. Cowper and Dr. E. H. Sharp.

737 Delaware Avenue.

DISCUSSION

DR. EATON: Was there but one dose of salvarsan given, or did you give it every week?

DR. SNOW: About eight doses were given.

A CASE WITH VASCULAR, JOINT, MUSCLE AND SKIN DISTURBANCES OF UNCERTAIN ETIOLOGY*

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The subject of this report is a child, aged 4½ years. There are two other children in the family who are normal. The family history is in other respects negative.

CLINICAL HISTORY

This child was perfectly well and had no symptoms until early in November, 1917. At that time she was vaccinated against smallpox. The vaccine used was the same as that employed in many cases without any unusual results. The reaction from the vaccination was violent with high temperature and the involvement of the glands in the groin. A few days after the vaccination had subsided her face became red and swollen about the eyes and she complained of a little stiffness in bending her knees. From that time until early in January there was a steady progress in the condition, until at the present time all the joints of the body are involved including the spine. This condition is shown in Figure 1. Passive motion causes slight pain. It is impossible fully to extend or flex any of the joints. The feet are held in equinus position. The muscles feel as in chronic state of contraction. She does not voluntarily use even her hands. She is able to walk if compelled to do so, but stands on her toes and complains constantly to be put back to bed. The edema and redness about the eyes has persisted (Fig. 2). There have been subconjunctival hemorrhages. The mucous membranes of the mouth about the teeth are red, edematous and hemorrhagic in spots. In appearance they closely resemble the gums in scurvy. Under the arms a macular erythema appeared and progressed to the loss of the superficial layers of the skin in some places and has resulted now in brownish pigmentation (Fig. 3). There is also a larger area of a diffuse pink blush extending down almost to the crests of the ileum and to the anterior and posterior axillary lines. The fingers and toes show at their tips a blotchy erythema resembling Raynaud's disease (Fig. 4). The skin almost

Fig. 1.—Showing the contractures which involved all of the joints of the body, including the spine.

Fig. 2.—Edema with marked redness of the eyes and eyelids.

Fig. 3.

Fig. 4.

Fig. 3.—Pigmented and erythematous lesions in the axilla.

Fig. 4.—Blotchy erythema of the fingers and hands; a condition which resembles Raynaud's disease.

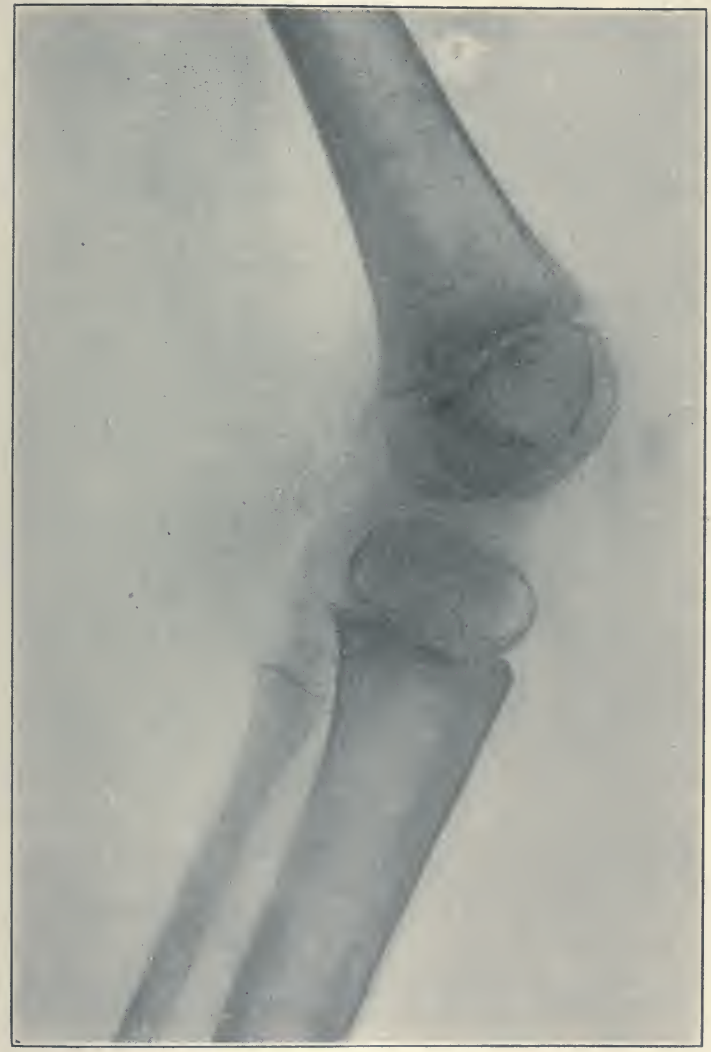

Fig. 5.—Roentgenogram of the knee joint which reveals nothing pathologic, peculiar skin condition seen in plate not visible in print.

everywhere, but more marked on the legs, arms and back, presents a brawny induration. The superficial layers cannot be pulled away from those beneath. In some portions, especially over the sacrum, there is slight edema. The lesions of every kind are absolutely symmetrical even to the position of the erythematous blotches on the finger tips. The skin feels a little dry, but perspiration is present. The hair is rather coarse, but abundant even on the upper portion of the back and on the arms. Previous to the onset of symptoms the child was cheerful and happy, but since the trouble began she has become very tearful, quiet and does not want to be disturbed.

PHYSICAL EXAMINATION

Aside from the lesions mentioned, the physical examination is entirely negative. There has been no fever. The blood is normal. The urine is normal except that in the last two weeks there have appeared a few pus cells and coincident with this a slight rise in temperature. The stool is negative, except at first there was a slight excess of starch. The blood pressure is normal. The pulse rate is 120. The Wassermann test is negative. The Von Pirquet test is negative. The blood culture is negative. The roentgenogram reveals nothing pathologic in the joints (Fig. 5). The sella turcica is normal. The teeth are normal. The subcutaneous tissues show a curious irregular striation unlike anything with which we are familiar.

SUMMARY

The striking features of this case are as follows: The very extensive symmetrical involvement of various portions of the body, the brawny induration of the skin, the vascular disturbance of the skin and mucous membranes, the stiffness of the joints, the roentgen-ray findings in the skin, and the change of disposition.

The etiology of this condition is extremely doubtful. We believe that the vaccination had nothing to do with it. Possibly some toxic agent has affected the glands of internal secretion. No focus of infection has been found. Some change in the vascular system is suggested by many of the findings. The skin may be primary and the other signs secondary to it. The most likely diagnosis seems to us to be a diffuse scleroderma.

So far as treatment is concerned, nothing has been done which has modified the course of the condition in any way. In the last three months there has been very little progression, and in the last few weeks there has been a slight tendency toward improvement.

DISCUSSION

DR. KOPLIK: As soon as I saw the announcement of this case I remembered that I had seen a case exactly like it in our service at the Mount Sinai Hospital. It is one of the rarest conditions one meets with in pediatrics. The history of our case was as follows: The patient had been treated for rheumatic pains in the joints by painting with iodin. She was a beautiful well developed Italian child. She complained of muscular pain and had a little edema. We took blood cultures. Finally we found that the edema was of a kind that seemed as though there was air in the subcutaneous tissues. We found only one bacillus in the culture, and the laboratory did not want to make a diagnosis on that. Later the skin became atrophic, there was pain in the muscles and joints and the child became incapacitated and emaciated. Every detail worked out just as in the case of Dr. Smith has reported. No one knew what the diagnosis was. Some thought it was a diffuse scleroderma. Dr. Sara Welt-Kakels came in, and when she saw the child, said she had seen a similar case; it was a neurodermomyositis, a condition which had been described by Oppenheimer. A marked eosinophilia was found to be present. The disease seemed finally to wear itself out and the child became a little better and was able to walk about, and was transferred to her home. These cases are very rare and are described by the neurologists as a neurotic condition. The general disease is not a skin disease, but the skin is affected along with the other structures. In our case we examined the muscle and found a general atrophy. We looked for trichinosis and other organisms, but did not find anything.

DR. BYFIELD: Did these patients have any itching of the fingers, and do you know whether there was edema of the distal phalanges of the fingers and toes, with desquamation? Was there any alopecia or photophobia? I have seen six cases of a somewhat similar condition in which, however, the signs and symptoms referred to by me were very intense.

DR. SMITH: In reply to the questions, the child had no great amount of itching and no desquammation except under the arms and the extreme tips of the fingers and toes. There was no eosinophilia. I feel that there must be some toxic agent at work. It is a question whether it is acting directly on the structures of the body, or whether it affects the various structures by acting through the glandular system.

PRELIMINARY REPORT ON THE USE OF VEGETABLE MILK IN CHILDREN

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AND
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Recent studies in the science of nutrition have shown that the food value of different articles cannot be estimated solely by their chemical formulae. As an example, I have shown that the milks of various animals cannot be compared by chemical ingredients alone, because one of the principal components, casein, reacts very differently in different species to the digestive enzymes.* The reason for this is that casein has a developmental, as well as a nutritional function to perform. Its purpose is evidently to develop a rapidly growing gastro-intestinal tract in such a way that the food necessary in later years can be easily digested by well developed areas in the alimentary tract of each species.

There is another factor — an imponderable — that must always be considered in feeding the young, namely, the vitamines. Without these, growth cannot take place. To the pediatrician, the matter of food is of primary importance, as he has not only to consider heat and energy production, but must lay special emphasis on growth. The period of the latter is limited, and once lost cannot be regained. It is hence evident that a very careful study of any substitute food must be instituted before it can be safely recommended. It is desirable, however, to have as great a variety as possible, especially when there is danger of a scarcity of any one article. Again, some foods may be useful and desirable as temporary substitutes, even if their more permanent employment would not be wise.

Attention has been frequently drawn to the high nutritive value of various nuts. But nuts eaten as such are not an easily digestible food, mainly on account of their consistency, which on faulty mastication are mechanically highly irritating to the small intestines and colon, and even on proper mastication, nuts are not easily borne by the intestinal tract of children, or, when in catarrhal state, in adults. But in the form of an emulsion the extracts of nuts become, mechanically

* The Function of Milk in the Scheme of Evolution, Scientific Monthly, January, 1916.

at least, very easily digested. Among the various nuts the almonds have received particular attention. Occasional references are to be found in American and foreign medical literature. My attention was drawn to the so-called almond milk by Dr. Ludwig Kast, who, at the Post-Graduate Hospital, has used it on his adult patients for several years. His experiences are shortly to be published with complete laboratory reports.

According to the chemical analysis, the composition of the almonds, on an average, is as follows: Fat 54.9; protein 21.0; carbohydrate 17.3; ash 2.0; water 4.8. The milk prepared from this nut has a good nutritive value, is pleasant and easy to digest and seems worthy of trial in various nutritional disturbances of early life. Sweet almonds on trituration with water yield a milk-white emulsion having the appearance and somewhat the taste of cow's milk slightly flavored with almonds. The nuts are first finely ground and then covered with water and allowed to stand in an icebox over night. The following day they are pressed out, using a potato ricer or fruit press, or they may simply be pressed out by hand through four layers of gauze, which is the method usually employed in our laboratory. One hundred gm. of nuts may be covered with 200 gm. of water, and when squeezed out this is diluted up to 300 c.c. of water. (No. III.)

Chemical analysis, reported by Dr. Kast, of the trituration of almonds and water gave the results shown in the tabulation which are here compared with an average analysis of cow's milk.

COMPLETE ANALYSIS OF ALMOND MILK

	Fat	Protein	Carbohydrates	Ash	Water
I	5.19	3.3	0.86	0.36	90.5
II	6.21	3.9	1.21	0.43	87.8
III	7.02	4.4	1.2	0.55	86.74
			COW'S MILK		
	4.0	3.3	5.0	0.7	87.0

MINERAL CONTENT

	Cow's Milk	Almonds (Whole Nuts)
CaO	20.01	14.5
MgO	2.42	18.3
Ma_2O	10.01	1.8
K_2O	25.02	11.1
MnO_2	.....	0.3
Fe_2O_3	.....	....
Al_2O_3	0.13	0.8
P_2O_5	24.29	48.1
SO_3	3.84	4.6
SiO_2	.....	0.2
Cl	14.28	0.3

If heated to 100 C., the solution becomes opaque and gradually deposits a snow-white precipitate amounting to about 10 per cent. of the emulsion employed. The almond milk must be kept cool to prevent the fermentation of its carbohydrate. It should be warm but not boiled when taken.

According to Foster, the almond was a highly esteemed medicament in the Hippocratic and Galenical eras, being used as an emulsion in pulmonary affections, in menstrual disorders and as a diuretic.

There seem to be certain advantages in the use of almond milk that may be considered from both a theoretical and practical standpoint. As regards the former, (*a*) it ferments much less easily than ordinary cow's milk; (*b*) it has a higher fat ratio in the form of almond oil which is sufficiently emulsified to render it easily digestible; (*c*) proteins contained in this milk are much less apt to undergo putrefaction than the casein of cow's milk; (*d*) almond milk contains a large amount of phosphorus and a small quantity of sodium chloride which would suggest its favorable employment in such conditions as rickets and nephritis. From its low carbohydrate content it would also be indicated in various sugar fermentations.

On the practical side, it has been tried on more than 1,000 adult cases by Dr. Kast, and while some dislike it, actual disturbances have never been caused. Thus far, no patients have shown any idiosyncrasy to it. Patients kept on almond milk alone maintain their equilibrium of metabolism and usually gain in weight. Accurate metabolism experiments carried out by Dr. Kast on 2 adults showed that the nitrogen balance was maintained. In nephritis, typhoid fever, intestinal putrefaction, malnutrition and secondary anemia it was particularly well taken and served a very good purpose.

A few trials of almond milk in infants and young children would seem to warrant further experimentation in various conditions. As the hardest kind of test of any food is to administer it to wasting infants in hospitals, it was tried in three such cases. These infants nearly always slowly lose upon any formula, so there was no hope of causing gain, but simply to see if the food would be digested and absorbed in such a condition.

Helen A., aged 3 months. On breast for three weeks and then on various milk formulae. She did not do well on the breast and continued slowly losing, until on admission she weighed less than her birth weight. She had from one to three stools daily that were light

yellow, green and brown, and varied in consistency. Urine negative. She was put on almond milk: fat, 1.9 per cent.; carbohydrate, 5.6 per cent.; protein, 1.2 per cent. She took it as well as the milk preparations, but without stopping the loss in weight. While on the milk formulae an examination showed the percentage of ether soluble material in the dry feces was 45 per cent., and 24 per cent. after the baby was fed on the almond milk. The proportion of fat in the two foods was about the same.

M. B., aged 2 months. Had been fed on the following milk formula: fat, 2.5 per cent.; carbohydrates, 6 per cent.; protein, 2.5 per cent. On this food the ether soluble material in the dry feces was 31.7 per cent. The baby was then changed to almond milk: fat, 3 per cent.; carbohydrates, 6 per cent.; protein, 1 per cent. At the end of the first twenty-four hours the ether soluble material in the dry feces was 40.3 per cent., and at the end of forty-eight hours 48.2 per cent. In the two days the baby gained 4 ounces, but as the increase in weight did not continue the experiment was concluded.

In the third case, a baby of 3 months, with extensive bronchopneumonia, took all milk feedings very badly and was rapidly losing weight. A trial of almond milk did not show any improvement, and after two days, milk feedings were resumed. An autopsy showed extensive bronchopneumonia and an atrophic thymus, fatty liver, hyperemia and mucoid degeneration of the intestinal mucosa, lymphoid hyperplasia and uric acid calculi in the kidneys.

In these difficult cases the change to the almond milk seemed to have about the same effect as the usual alteration of formulae is apt to have in this type of case. It was digested and absorbed about the same as the cow's milk preparations.

The almond milk was substituted for cow's milk as a beverage in six cases over 2 years of age. Three took it well and seemed to like it, and the other three did not fancy it as well as the cow's milk. One boy of 2 years with Pott's disease and tuberculous peritonitis drank it for eight days with other food, during which time he gained in weight and liked it as a beverage.

Further clinical observations of children are in progress.

MIGRAINE IN CHILDHOOD

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While migraine in later childhood differs in no respect from the disease as seen in the adult, its recognition in infancy and early childhood offers considerable difficulty, owing to the inability of the patient to describe symptoms accurately.

As is well known, migraine is often a hereditary disease, being directly inherited in about 50 per cent. of the cases. Not infrequently it has been known to occur in three or even four generations. It has not yet been ascertained whether or not the mendelian laws govern its inheritance. Like other hereditary diseases, it may be congenital, though this is exceptional. Such was the case with Russell's patient,[1] who had the first manifestations at the age of 2 weeks, with attacks regularly thereafter every two weeks; at the age of 7 years the disease changed to the ophthalmoplegic type.

Age at Onset.—In Flatau's[2] large series of 307 cases, the disease began most frequently from the sixteenth to the thirtieth year, but in 21 per cent. the onset was before this period and in 12 per cent. before the eleventh year. In only 1 per cent. did it begin during the first five years of life. Gowers,[3] however, found a larger incidence in childhood, about one-third of his cases beginning between the fifth and tenth years, and two-fifths between the ages of 10 and 20. All writers agree that it is rare in the first half decade.

Symptomatology.—In infancy the symptoms are obscure and the attacks are of shorter duration than in the adult, lasting only a few hours. There are periodic attacks of vomiting, associated with pain and restlessness, and sometimes convulsions; the temperature is often somewhat raised. Constipation is the rule, in contrast with gastro-enteritis, a disease which is in other respects somewhat similar to migraine at this period of life.

In early childhood the attacks are more like those in the adult, though the pain is less often localized in one side of the head, and sensory and ophthalmic symptoms are less common. Of great interest

1. Russell, J. W.: Brit. Med. Jour., 1903, **1**, 1020.
2. Flatau, E.: Die Migräne, Berlin, 1912.
3. Gowers, W. R.: Diseases of the Nervous System, Ed. 2, 1898, **2**, 836.

is the association with cyclic vomiting, which is apparently not very uncommon. Usually cyclic vomiting appears first and is replaced later in childhood by migraine, but in the case of Comby[4] migraine appeared at the age of 2, and was replaced by cyclic vomiting at the age of 8, while in one of Fabre's[5] cases, a girl of 9, migraine came first, but did not cease with the appearance of cyclic vomiting.

The association with epilepsy is rare in childhood.

Increased intestinal putrefaction is a rather frequent accompaniment of migraine which is often overlooked. While it is not constant, and therefore cannot be the cause of the disease, it appears to aggravate the attacks, and hence is worthy of consideration. The examination of the urine for phenol will often reveal such putrefaction where the test for indican is negative. It cannot be too strongly emphasized that the amounts of phenol and of indican in the urine are quite independent of one another. The reason for this is that phenol is derived from the tyrosin portion of the protein molecule, while indican is derived from tryptophan. It is possible that one set of intestinal micro-organisms attacks tyrosin, and another tryptophan. A simple test for phenol in the urine is the following: 100 c.c. of urine are distilled with 5 c.c. of strong sulphuric acid until one-half of the liquid has gone over, and to the distillate is added bromin water in excess. The presence of a definite white precipitate (tribromphenol) indicates the presence of phenol in excessive amounts.

Recent work by Folin and Denis[6] and by Dubin[7] has thrown new light on the physiology of the phenols. This has been rendered possible by a new colorimetric method, devised by Folin and Denis,[8] by which phenol, both free and combined, can be determined rapidly, and with accuracy. Contrary to the long-prevailing opinion, Folin and Denis have shown that the greater part (about 80 per cent.) of the phenol in the urine is normally excreted in the free state. Dubin, however, found that if phenol is administered in large amounts to dogs, a very marked increase in the conjugation takes place. It would appear, therefore, that the protective mechanism by which phenol is rendered harmless is called into play only when excessive amounts have to be cared for. The total amount of phenol, both in animals and in man, was found to vary directly but not proportionally with the intake of protein.

4. Comby, J.: Arch. de méd. d. enf., 1901, **4,** 9, Observation 11.
5. Fabre, E.: Migraine chez les enfants. Thèse de Paris, 1904.
6. Folin, O., and Denis, W.: Jour. Biol. Chem., 1916, **26,** 507.
7. Dubin, H.: Jour. Biol. Chem., 1916, **26,** 69.
8. Folin, O., and Denis, W.: Jour. Biol. Chem., 1915, **22,** 309.

After the use of enemas and of cathartics the amount is lowered appreciably.

The nature of migraine is still little understood. The analogy with epilepsy is very close; in both conditions there is a strong hereditary element; in both periodic cerebral attacks, affecting in the one case the sensory, in the other the motor sphere. Moreover, the two diseases often have been found in the same person, migraine occurring first, being replaced later by epilepsy.

A comparison with asthma, another hereditary disease, suggests another point of view. Here again are periodic attacks, with intervals of good health. The symptoms of asthma resemble closely those of anaphylactic shock in the guinea-pig, and for many cases a hypersusceptibility to certain proteins has been demonstrated. It has been attempted to explain migraine also as a manifestation of anaphylaxis, but thus far without success. It is true that indiscretions in diet may precipitate an attack of migraine, and that a low protein diet is beneficial in some, though by no means in all cases, but hypersusceptibility to proteins has not been shown by direct methods, eosinophilia has not been reported, and the symptoms are not similar to those of experimental anaphylaxis.

A disorder of metabolism is another possibility, for which there are analogies among inherited diseases, such as diabetes and gout, in which there is direct heredity, and those rare anomalies of metabolism, pentosuria, cystinuria and alkaptonuria, in which, however, the condition is congenital and familial but not hereditary. Moreover, diseases of metabolism may show marked periodicity, as in gout, and that rare disease known as family periodic paralysis, in which Edsall and Means[9] have recently shown decided disturbances of metabolism, in the shape of increased basal metabolism during attacks, and a long continued marked increase of the nonprotein nitrogen of the blood, in the absence of nephritis. Very little work has been done on the metabolism in migraine, and this should offer a good field for future investigation.

It often has been attempted to explain the symptoms of migraine on the basis of an abnormal reaction of a diseased central nervous system to stimuli which in the healthy person would produce no effect. In favor of this view various signs of a disturbed vasomotor and sympathetic innervation during the attack have been adduced. But this theory altogether fails to explain the most striking feature of

9. Edsall, D. L., and Means, J. H.: Am. Jour. Med. Sc., 1915, **150,** 169.

migraine, namely, the periodicity of the attacks, and the sense of well being during the intervals.

To sum up, the cause of migraine remains obscure. The hypothesis of intoxication by the products of a disordered metabolism seems at present to offer the best basis for investigation.

Diagnosis.—The diagnosis rests chiefly on the periodic occurrence of headache, accompanied usually by nausea and vomiting. The intervals between attacks vary from one to two weeks up to several months in duration, and are free from symptoms, unless the attacks follow one another very closely. It is not essential that the headache should be confined to one side; in case it is not, it is usually frontal, rarely occipital. Scintillating scotomas, numbness of one side of the body and other ophthalmic and sensory symptoms are not a necessary part of the disease, and in fact are rare in childhood. A family history of migraine is of much diagnostic value. In young children the diagnosis may be difficult on account of their inability to describe symptoms. The periodicity of the attacks, however, and the state of well-being between them, together with the exclusion by careful physical examination, of other causes of headache, will usually enable one to arrive at the correct conclusion.

From cyclic vomiting it is differentiated by the following features: in migraine the headache precedes the vomiting, and is the predominating symptom, while in cyclic vomiting the headache is usually not severe, and the vomiting is frequent and intractable. The presence of large amounts of acetone in the urine is constant in cyclic vomiting, and also in migraine providing vomiting is present, but in the former it may precede the attack, and in that case has diagnostic value.

Treatment.—A thorough examination of the patient, with especial attention to the eyes, nose, throat, accessory sinuses, teeth and digestive tract, is a prerequisite of intelligent treatment. While it is doubtful if true migraine has ever been cured by the correction of refractive errors, of nasal troubles or by alterations of the diet, it is true that any measure that improves the patient's general condition is likely to ameliorate the severity of the attacks, and to reduce their frequency. For this reason any abnormalities which are capable of correction should receive attention.

The diet is of considerable importance. It is well known that some persons have fewer attacks if meat and fish are excluded. This effect was formerly attributed to the influence of a purin-poor diet on the uric acid diathesis, which was erroneously supposed to play an important

part in migraine. It may well be due to the reduction of an increased intestinal putrefaction, a factor which should always be looked for. If it is present, meat, fish and eggs should be excluded from the diet, and the effect on the excretion of phenol and indican noted. In some cases it may be even necessary to exclude milk to attain the desired result. Constipation, if present, of course should be corrected, as tending to increase intestinal putrefaction.

In a few cases attacks apparently are precipitated by overindulgence in corbohydrates, such as candy.

Attention to hygiene is an essential part of the treatment. It is often necessary to withdraw the child from school for a while, and to limit the hours of study and reading. An abundance of fresh air and exercise in amounts suited to the individual are indicated.

The use of drugs during the attack should be limited, since in small doses they have no effect, and in large doses they are apt to be deleterious. Of the antineuralgics, caffein seems to have the best effect. Morphin may be required in very severe paroxysms. The administration of drugs during the intervals, with the purpose of reducing the severity and frequency of attacks, has proved disappointing in my hands, though recommended by Oppenheim and other authorities.

By the use of the above measures the frequency and severity of the attacks are usually lessened, but it is doubtful if true migraine is ever cured.

The following case seems worthy of report on account of the unusually early incidence of the disease and the presence of large amounts of phenol in the urine.

REPORT OF CASE

History.—H. B., a boy, aged 6 years, was seen March 1, 1918, in consultation with Dr. H. M. Steele.

Family History.—The maternal grandmother and a maternal aunt have suffered severely from typical migraine. The parents and a sister aged 4 years are free from headache.

Past History.—This is negative except for the fact that as an infant he used to lick the paint off the bed.

Present Illness.—Since the age of 3 years, he has been subject to periodic attacks of headache, accompanied by vomiting. Acetone occurs abundantly in the urine at these times, a feature which had led to the diagnosis of cyclic vomiting. The attacks come at intervals of from one to three months, as a rule, but during the previous winter have occurred about once a week. There is an aura the day before, consisting of pallor, nervousness and an abnormal appetite, usually poor, but sometimes increased to a pathologic degree. The headache is intense and always precedes the vomiting; it is bilateral and frontal in distribution and accompanied by photophobia. The duration of the attack

is about twenty-four hours. Between attacks the boy is well and free from headache. There has been a distinct intolerance of eggs; if he takes more than one egg a week he is almost certain to have an attack. He has not taken large quantities of meat.

Physical Examination.—A fairly developed boy, 45 inches in height, weighing only 37 pounds (the normal weight for this age is 45 pounds). The head is rather square, but there are no other signs of rickets. The tonsils are moderately enlarged. The heart, lungs, abdomen and reflexes are negative. The systolic blood pressure measures 82 mm., the diastolic 50. The examination of the eyes by Dr. E. M. Blake, shows a considerable degree of hypermetropia (+2 D.). The hemoglobin is 90 per cent. The blood smear shows a considerable increase in lymphocytes, the count being as follows: polynuclear nuclears, 35 per cent.; lymphocytes, 58.5 per cent.; large mononuclear and transitional cells, 4 per cent.; eosinophils, 1 per cent., and mast cells, 1.5 per cent. The red cells are normal.

Urine: Twenty-four hour amount, 500 c.c., color normal, reaction acid, specific gravity 1.015, albumin sugar and indican absent, *phenol present in large amounts,* acetone present (during the attack), sediment negative. Examination of the feces for lead is negative.

Treatment.—The treatment consisted in withdrawal from school, the correction of the refractive error and alteration of the diet. Throughout the month of March no meat or fish was eaten. During April the child was put back on his former diet. It was now found that he had an increased tolerance for eggs, which he craves, being able to take three or four a week without headache. Examination of the urine April 16 and May 22 still showed large amounts of phenol; during March, when the protein intake was restricted, no examination was made. In spite of the phenoluria he has been practically free from headache since beginning of treatment, having had but one slight attack from March to the date of writing, June, 1918.

COMMENT

The beneficial effect of even a temporary diminution of the protein intake is shown in the almost complete disappearance of the headaches, and in the increased tolerance of eggs. Further restriction of protein is indicated, until the excretion of phenol reaches normal limits.

424 Temple Street.

DISCUSSION

DR. SCHLOSS: This paper has interested me much, because recently I had a case of the same type described by Dr. Tileston. The child was 8 years of age and had typical migraine attacks, often as many as three a week, and complained of a distinct aura, the scintillating scotoma described by Gowers. The child would have very severe pain for an hour or two, and then would be perfectly all right again. He was fairly well developed and well nourished, and no focus of infection could be found. The urine showed a great deal of phenol and indican constantly. The child was put on an almost protein-free diet, getting only the protein contained in a few vegetables, being restricted to those containing only a very small amount of protein. The attacks formerly occurred two or three times a week. Since the change in diet, he has had only about one attack in six weeks, and these are much milder than before. The urine still has a trace of indican and phenol at times.

ENERGY METABOLISM OF AN AMAUROTIC FAMILY IDIOT *

FRITZ B. TALBOT, M.D.
BOSTON

The following case of amaurotic family idiocy was obtained from the Children's Hospital through the kindness of Dr. John Lovett Morse, and studied under the direction of Dr. F. G. Benedict at the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Mass.

HISTORY OF CASE

History.—The child, B. D., girl, aged 2 years and 4 months, was admitted to the hospital Nov. 22, 1916. The father and mother, brother and sister were living and well, and were of normal mental and physical development. There was a normal family history.

The patient was born of a normal pregnancy and labor, and was breast fed for one year, during most of which time she had a severe facial eczema. At 3 to 4 months she first noticed her hands, but never made any effort to use them except to play with a rattle, when it was placed in them. If she dropped the rattle, she was unable to find it, nor could she pick it up if her hands came in contact with it by accident. She never played with anything else, and had never been able to hold up her head or sit up.

Dec. 24, 1915, she had a convulsion during which the extremities jerked for an hour or more, the eyes were rolled up, and she perspired and drooled. In February, 1916, she entered the Infants' Hospital and Dr. George H. Derby found on examination of the eye grounds, "secondary atrophy of the optic nerve heads, and cherry-red spots in the macular regions with edema about them." She entered the Children's Hospital because she was mentally backward, could not see, and was only able to take liquid food. She took no notice of her surroundings, and lay quietly except when startled by a noise, which could cause a temporary clonic convulsion of all the extremities. Except during these periods of spasm, she lay absolutely still, without any voluntary movement.

Physical Examination.— This showed an underdeveloped, poorly-nourished child, lying quietly in bed, drooling constantly and taking no notice of the surroundings. The extremities were cold and the feet slightly blue. The head was large in proportion to the body. Both pupils reacted to light, but the right was slightly larger than the left. They were regular in outline. The physical examination otherwise revealed nothing abnormal except that the extremities were spastic and markedly atrophied. There were no signs of voluntary motion. The von Pirquet test was negative. The white count was

* From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston.

9,800. The urine was acid, cloudy, straw colored and contained the slightest possible trace of albumin. The sediment contained many pus cells. Lumbar puncture, 8 c.c., clear fluid under normal pressure. Cell count 7, of which one was a leukocyte and six were epithelial cells. The Wassermann reaction was negative. From December 5 to 12, the week preceding the time that the metabolism was observed, the child's temperature was subnormal, the lowest being 95.5 F. At times during this period the pulse registered 69. This was lower than the careful pulse records taken during the metabolism periods. She never cried and lay absolutely quiet in bed except when disturbed by a sudden, loud noise or by being touched. External stimuli of this sort caused clonic convulsive movements. During this period she simply existed in bed, taking her food as it was given to her. She died Dec. 26, 1916, probably of inanition as a result of pyelitis and amaurotic family idiocy.

Necropsy.—Postmortem examination by Dr. S. B. Marlow showed a few facts of importance when taken in connection with the metabolism. The body was 75 cm. long and showed extreme emaciation. The skin was everywhere loose, and even on incision showed no subcutaneous fat. The muscles were atrophied and showed very little rigor mortis; they were pale and thin in appearance. There was no fat in the mesentery or the retroperitoneum. In fact, the absence of fat was so conspicuous that special emphasis was laid on it in the report of the pathologist. The brain nowhere filled the cranium and was from 0.5 to 1 cm. distant from the bony wall of the skull. The dura over it was loose and collapsed, giving the impression that it had been previously distended with fluid. The meninges about the spinal cord were edematous and distended. The eye when removed showed at the macula a deep colored spot about 1.5 cm. in diameter, surrounded by a gray ring 2 mm. wide. The rest of the examination showed nothing of importance to record here.

The child had, therefore, amaurotic family idiocy and pyelitis. She was extremely thin and emaciated, and moved in bed only when disturbed by sound or touch. The amount of muscular activity during the day was so slight that it was almost negligible, except during the clonic convulsions. There was no storehouse of fat on which to draw for energy when desired, as is found in the new-born infant. Although most of the remaining body tissue was muscle, bone and organs, the muscles were thin and atrophic, and could not, therefore, be said to represent normal muscle. Although clinically the actions of this infant were similar to those of the child without any cerebral hemispheres, previously reported by me,[1] physically the two infants were quite different. In this case there was an almost complete absence of fat, while in the other, the body was composed almost entirely of fat. Table 1 gives the energy metabolism of B. D. The length of the periods of observation of this baby and the babies subsequently reported was, in all instances, thirty minutes.

1. Talbot, F. B.: Arch. Pediat., 1915, **32,** 452.

TABLE 1.—Basal Energy Metabolism of B. D.*

Date	Body Weight and Surface	Height, Cm.	Heat Produced per 24 Hours				Average Pulse Rate	Relative Activity
			Total Cals.	Per Kilogram, Cals.	Per Sq. Meter			
					Lissauer, Cals.	DuBois Linear, Cals.		
12/11/16	6.41 kg.	76	283†	..	...	...	83	Active
	$10.3\sqrt{wt_2}$ = 0.355 sq. m.		246	38	693	603	83	Quiet
	Du Bois Linear = 0.408 sq. m.		250	39	704	613‡	86	Quiet
			250	39	704	613	91	Quiet

* One ounce of milk was taken four hours before observations were commenced.
† Preliminary period not used in calculation.
‡ Average respiratory quotient, 0.82. Temperature, rectal, 97 F. beginning of periods: 96.8 F. at end of periods.

TABLE 2.—Comparison of Basal Metabolism of B. D. with That of Normal Infants of Approximately the Same Weight

Name	Age, Mos.	Body Weight Without Clothing, Kg.	Height, Cm.	Heat Produced per 24 Hours				Periods Averaged	Pulse Rate
				Total Cals.	Per Kilogram, Cals.	Per Sq. Meter			
						Lissauer, Cals.	DuBois Linear, Cals.		
1. B. D.	28	6.41	76	249	39	700	610	3	87
2. M. C.* (normal infant)...	4	6.17	63	333	54	967	...	7	103
3. R. A.* (normal infant)...	7	6.42	65	358	56	1,002	...	3	118
4. N. D.* (normal infant)...	7	6.79	67	381	56	1,082	...	5	100

* Benedict and Talbot: Am. Jour. Dis. Child., 1914, **8**, 1.

TABLE 3.—Comparison of Basal Metabolism of B. D. with That of Normal Infants of the Same Age

Name	Age, Mos.	Body Weight Without Clothing, Kg.	Height, Cm.	Heat Produced per 24 Hours				Periods Averaged	Pulse Rate
				Total Cals.	Per Kilogram, Cals.	Per Sq. Meter			
						Lissauer, Cals.	DuBois Linear, Cals.		
1. B. D.	28	6.41	76	249	39	700	610	3	87
2. M. R.*.....	25	10.96	79	617	56	1,214	1,135	3	104
3. Gr. Mc.L.*.....	26¼	12.24	88	605	49	1,107	1,028	3	96
	29½	12.82	91	602	49	1,101	1,025	4	112

* Not previously reported.

Although the weight of these normal infants is quite close to, and in most instances almost identical with, that of B. D., their length is much shorter and, therefore, they are much fatter. However, they give an idea of what B. D.'s metabolism should have been if the body had been developed normally in relation to the weight. The basal metabolism of B. D., compared to that of three normal infants of the same weight, is very low (approximately 30 per cent. lower than the normal for the weight).

TABLE 4.—COMPARISON OF METABOLISM OF PATHOLOGIC CHILDREN

Name	Age, Mos.	Body Weight Without Clothing, Kg.	Height, Cm.	Heat Produced per 24 Hours				Pulse Rate
				Total Cals.	Per Kilogram, Cals.	Per Sq. Meter		
						Lissauer, Cals.	DuBois Linear, Cals.	
1. B. D.	28	6.41	76	249	39	700	610	87
2. J. J. M.	8	8.43	73.5	239	28	560	...	73
3. Cretin, C. G.[2]	44	11.83	85	464	39	867	...	95

The metabolism of these normal infants gives an idea of what the metabolism of B. D. would have been had she developed normally for her age. Her total metabolism is less than half that of three average normal infants, and her metabolism per unit of body weight or body surface were both decidedly low.

The metabolism of this amaurotic family idiot is, therefore, very low both when compared to that of normal infants of either the same weight or normal infants of the same age. Her metabolism is comparable to that of J. J. M. who had no cerebral hemispheres,[1] and, therefore, moved only when stimulated to do so by touch. This child moved both when touched and when disturbed by noise. The body was run at such a low economic level that very little food was necessary for life.[1]

The interpretation of the metabolism of B. D. is extremely difficult, as we have a picture of great emaciation, in which a large proportion of the body tissues are muscle with almost no fat. The pulse rate, which, at the time of the observation, was relatively high or normal for

2. Talbot, F. B.: AM. JOUR. DIS. CHILD., 1916, **12**, 145.

the age,[3] was low at times in the hospital. Under these conditions a high metabolism rather than a low metabolism might have been expected, as has been recorded in the findings of Publication 201 of the Carnegie Institution of Washington. As a matter of fact, the metabolism was very low. The rectal temperature of 97 F. during the period of observation was not an extremely subnormal temperature, but it is not impossible that this may be an indication of lowered vital activity, although it is quite unreconcilable with the relatively high pulse rate.

In conclusion, this child with amaurotic family idiocy presents a very unusual and complicating situation, in which the metabolism may have been modified either by the subnormal temperature, by emaciation, by the plane on which the baby was living, or by the disease, and does not present any simple explanation. It is hoped that other records of the metabolism of amaurotic family idiots will clear up the doubtful point presented in this picture.

311 Beacon Street.

3. In designating the pulse rate of B. D.—83 to 91, as shown in Table 1—as high, or relatively high, it must be remembered that it is not logical to say the pulse rate in a given individual is abnormally high. It has been often pointed out in the Nutrition Laboratory of the Carnegie Institution of Washington, that it is not permissible to argue that a high pulse rate in any given individual absolutely implies a high metabolism. What is more important is the deviation from the normal pulse rate of that individual.

IS THE PRESENT FREQUENCY OF ACUTE OTITIS AND OF SUBSEQUENT MASTOID OPERATION IN SOME MEASURE A REPROACH TO PEDIATRICS?

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NEW YORK

The importance of the question raised in the title of this paper must be the excuse for its presentation. Whether it is timely or not will be shown by the discussion which it provokes. The prevalence of acute middle ear trouble, often eventuating in mastoid operation, would, when we consider the growth of preventive measures in other directions, appear to be a reflection on therapeutics and medical research in general, and since these affections are so common in early childhood, on pediatrics in particular.

So far as the author knows, no progress has been made during the last decade or, one might safely say, for a much longer period, toward definitely aborting acute otitis media. We may probably grant that prompt paracentesis of the drum has largely decreased the number of persons suffering from chronic disturbances of the middle ear, since we believe that it relieves congestion and pressure and often prevents the development of a suppurative process. We may further admit that the mastoid operation has saved many lives that would otherwise have been sacrificed, but if we may judge from their common occurrence very little has been accomplished by way of prophylaxis for these two conditions.

It is true that middle ear inflammation is more promptly recognized than formerly and while this may account for the apparently increased number of such cases, early paracentesis does not appear to have reduced markedly the number of cases of threatening mastoid involvement. Prophylaxis, therefore, in order to have a maximum effectiveness, should be chiefly directed against the occurrence of the otitis media. Removal of adenoids and tonsils is along this line, and should be credited with playing a part in the cure of subacute and chronic ear conditions, but, alas, as we all know, it does not always prevent the recurrence of otitis.

Paracentesis and mastoid operation appear to be placed in the same category as immediate operation for appendicitis, the view in each instance being that the earlier the operation the less the danger of serious later developments. There is, however, this difference, that removal of the appendix or mastoid cells eliminates future danger from that particular source, while paracentesis is only a temporary protective measure with no absolute guarantee for the future, and possibly occasionally furnishing an avenue for the entrance of further trouble.

In an inquiry of this sort into the factors of a situation which all will probably admit is far from satisfactory, we should not hesitate to give consideration to personal impressions derived from clinical experience, even though these be not fully proved, since they may contain the germs of a forward movement. It is admittedly a not very uncommon experience to detect a serous infusion into the middle ear in its early stages, to subject the patient to immediate paracentesis at the hands of an expert and scrupulously aseptic operator, to have a drop in temperature with a serous discharge for a day or two, only to have this followed by a sudden profuse purulent discharge, a rise of temperature, the classical indications of mastoid involvement, and operation.

One naturally asks one's self whence came the severer infection, and would this have taken place behind an intact drum membrane? Did the douching carry in contaminations, or was it an inevitable lighting up of the original process? Would that particular case have done better or worse under expectant treatment, or, granting recovery without paracentesis, have resulted in retraction and adhesions which would have ultimately been worse for the patient than being subjected to the mastoid operation? Furthermore, is it utterly impossible for modern medical research to devise some method of preventing a serous otitis from becoming purulent, even with the aid of such access to the middle ear as may be afforded by the incision in the drum?

The question may perhaps be properly asked, whether the reopening of these questions will do more harm by seemingly confirming the half-baked opponents of proper and necessary operative measures, or whether this will be outweighed by stimulating thought in a somewhat neglected field. I have elected to believe the latter. Otitis is not only a common incident in our winter practice, but has come to be almost an annual infliction in some families. I make haste to say that

this statement is based quite as much on a knowledge of families who are under the care of other careful and conscientious practitioners as under my own. Otitis is frequently painful in its early stages. Its relief involves the risks of anesthesia, however slight these may be in competent hands. It is always a source of anxiety because of the frequency with which even in seemingly favorable cases the indications for mastoidectomy supervene. Yet for many years we have been content to accept otitis as an act of providence, and considered its outcome to be on the knees of the gods. Is there nothing that we can do about it?

We have here a territory partly occupied by the otologist and partly by the pediatrician. Possibly because of this divided responsibility the field has not been covered as thoroughly as it would have been had it lain only at one door. Does not the pediatrician stand somewhat in the same relation to the otologist and aural surgeon as he formerly stood with relation to the obstetrician until the right of the infant was recognized to be of primary, not secondary, importance? The majority of these cases of otitis develop in pediatric hands. Ours is the opportunity to foresee and prevent them. Has the time not come when it behooves us to make some greater effort to devise measures for the prevention of these distressing aural cases?

At this point it may be well to refer frankly to certain independent views which appear to be prevalent among pediatricians in the infant wards of hospitals and institutions where otitis is common, yet operations for mastoid involvement are infrequent. The middle ear of the infant is very vulnerable to acute infections, so much so that otitis is at times almost epidemic when many infants are gathered together and subject to the same infections of the upper respiratory tract. Nevertheless, the question constantly arises why so much larger a proportion of these hospital and institutional infants escape mastoid operation when, after paracentesis, the expectant plan of treatment is followed, than in private practice? In a long experience among institutions for infants the number of cases subjected to early paracentesis and receiving adequate after care which have developed unmistakable mastoid symptoms has been very small indeed.

As an example, during the past winter I have had twenty-five cases of acute otitis in a service averaging about eighty infants under 15 months of age. These have been under the close supervision of the visiting otologist, who has found in some five of them indications of

mastoid involvement, yet all have escaped mastoid operation, and discharge has ceased under treatment in all the infants save one, which at the time of writing is nearly well. This would indicate that the uregency of mastoid operation in the presence of the usually accepted syndrome of symptoms is not always so great as it has been considered in some quarters.

There is a growing tendency on the part of pediatricians to question the too inelastic application of the classical indications for mastoid operation as today accepted by aural surgeons. The pediatric trend appears to be to hold off immediate operation until clearly inevitable. If this course is a wise and reasonably safe one, which I neither affirm nor deny, it follows that pediatricians should play their part in formulating or revising these indications for the benefit of others. Yet it must be said that in a number of instances which have come to my knowledge, such nonacceptance of the classical standards at the hands of others has served only to delay the evil day and further endanger the patient while confirming the original view of the surgeon.

My chief desire, however, is to arouse interest in the search for prophylactic and abortive measures, of which we stand in great need. Acute otitis media, although one of the commonest of afflictions arising in pediatric practice, has not, so far as the author knows, been made the subject of any investigation from a pediatric standpoint, our knowledge and procedure being dictated by otology.

Formerly earache was treated by the instillation of various ear drops into the auditory canal. These have been largely swept into the discard by the aural surgeon, as inefficient or obscuring his field of vision. Aside from the more antiquated use of laudanum and hot oil, so strenuously objected to by the otologists, there have been more recent combinations of cocain, adrenalin, carbolic acid, alcohol, glycerin, etc., designed not only to relieve pain but to reduce engorgement and act antiseptically by absorption or osmosis. Should we not again ask ourselves whether these had absolutely no efficacy, whether they could not be made to have abortive power in a certain percentage of early cases, which might thus be spared paracentesis with its very real discomforts, if not real danger of transforming a simple effusion into a purulent one by contamination from the external auditory canal?

Nasal douching, and, to a considerable extent, nasal spraying, have been abandoned, owing to the outcry of the aurists that because of the size, position, and patency of the Eustachian tubes in early life,

the danger from such procedures far outweighs their advantages. Some otologists, be it said, still employ and recommend the use of the cleansing, medicated spray in acute nasopharyngitism, coupled with precautions as to the manner and force of blowing the nose. Dr. W. L. Culbert of New York directs that the nose in such conditions should never be blown lying on the back, as in bed, but with the head dropped well forward. Only one side of the nose should be blown at a time, and gently, not forcibly.

The warning against blowing the nose in the recumbent or supine position is one of such eminent and evident wisdom that I have now extended it to routine directions in all cases of acute infectious diseases in which there is danger of middle ear involvement through the Eustachian tube. It is logical to accept that when lying on the back, secretions tend by gravity to collect about the orifices of the Eustachian tubes, and that the risk of accident is decreased by hanging the head well forward. In this latter position gravity contributes to the expulsion of secretion and less forcible blowing is required.

Having been taught to fear the spray for cases in early life, I have long substituted dropping into the nose oil — albolene, plus such antiseptics as eucalyptol — as being less liable to penetrate the tubes or, in the event of so doing, they carry with them bactericidal properties. While distinctly helpful in combating coryza and nasopharyngeal infections, this procedure does not always prevent the development of an otitis. The principle, however, of the instillation of oily solutions of antiseptics — possibly with an oil of greater specific gravity than albolene — would appear to be capable of further development for purposes of prophylaxis.

For purposes of discussion I would conclude by asking these questions:

1. Are there any therapeutic measures which tend definitely to prevent middle ear infections in acute nasopharyngeal conditions?

2. Are there any abortive measures which are reasonably efficient in beginning otitis media?

3. Could not some such measures be devised by well-directed research?

4. Are we correct in assuming that immediate, early paracentesis is always indicated in all cases of effusion into the middle ear?

5. To what degree and under what circumstances after paracentesis is the pediatrician justified in counseling delay in the presence of the classical indications for mastoid operation?

6. Is the frequency of acute otitis and of mastoidectomy inevitable, or is it due to a complacent neglect of further research in this field?

Certainly the wide experience of the members of this Society should enable them to contribute something toward the solution of these problems.

807 Madison Avenue.

DISCUSSION

DR. LA FÉTRA: Dr. Southworth has brought forward a most important question for our discussion. Otitis media can be prevented or aborted and the necessity for these operations diminished, it would be most illuminating to hear of them.

DR. ADAMS: This subject is too important to let go by without discussion. It brings up so many different problems that might or might not be solved by a society of this sort, that it is hard to limit the discussion. In these days of specialism a pediatrist has charge of a child, but when he calls in an otologist he has little to say; he steps aside and the otologist steps in, and no matter how courteous he may be, one still feels that he is master of the situation, and is responsible for the further course of treatment of the mastoid or middle ear disease.

My experience has been that the otologist advises the general practitioner not to put drugs into the ear to allay pain, because he claims that they do not allay inflammation and obscure the field of vision, making examination difficult. Yet I have known otologists to put those same things in the child's ear. The preparations usually employed for this purpose are phenol, adrenalin or cocain. The otologists say these things are all wrong, and the only thing to use is a hot douche, with boracic acid, which may avert the attack.

Now, the question of puncturing a drum: It is well to remember that one may get an infection of the middle ear from within as well as through an opening in the drum. If the opening is properly made the germs are caught in the auditory canal by the escaping fluid. I have used a 5 or 10 per cent. solution of phenol in glycerin which has certainly allayed earache; that is, where there was no inflammation of the middle ear, but where the membrane was red and inflamed but not bulging. When the membrane is bulging we should call in a skilful otologist; and then, like many others, I have stepped aside and the otologist has assumed the responsibility

DR. PISEK: I have put similar questions to the otologist, but I have found that the otologist is not always certain in his own mind as to the indications for operation. He wants the pediatrician to exclude other possible conditions and then if the child has a discharging ear and elevation of temperature, with a sagging canal, he is ready to operate. A conservative otologist is the only one I am willing to call in on my cases. This is one instance in which I am not willing to have the family make the choice of a specialist, because I believe the conservative man will often carry the child through without operation. Some otologists tell us that every discharging ear represents practically a mastoid infection and that drainage through the canal does little good; that

the only way to get proper drainage is to open the mastoid. They fear that if it is left alone it will go on to sinus thrombosis or meningitis. I think that the otologists in cases that seem to be of importance lean more to the side of operation, for they feel that there is an element of safety on the side of operation.

DR. TALBOT: The problem of prevention lies in the prevention of colds, which are the cause of most ear troubles. The baby's nose should be wiped and not blown, and the same thing applies to older children.

DR. ABT: When we consider the relation of the middle ear to the nasopharynx, it is evident that as soon as we get a nasopharyngeal inflammation we are likely to have a middle ear congestion and the tympanic membrane becomes reddened, though slight redness should not constitute an indication for immediate puncture. The membrane should only be punctured when it is bulging, or if there is a reasonable suspicion of pus in the middle ear. I think there are times when even the most skilled physician has difficulty in seeing the tympanic membrane very well.

So far as mastoiditis is concerned, the pathologic studies show that in exanthematous and grippal diseases there is more or less inflammation of the mastoid and antrum. Many of these children recover without operation. One pathologist has stated that as many as 90 per cent. of children with exanthemata and grippal affections have mastoid involvement.

DR. HEIMAN: I have learned to be extremely conservative after a drum has been opened with no indication present. Some teach that every red drum should be opened. Every pediatrist should examine the child's ears himself. Even if the otologist advises incising the ear drum I am frequently ready to take the responsibility of waiting and watching for developments. It is perfectly safe if you see the case each day. I have seen as many mastoids follow incision of the drum as when we allowed the drum to remain red for some time without incision. In comparing my experience of former years with that of more recent times, I may say that it has changed considerably. Formerly I had three or four mastoids a year, and now about one mastoid case in ten years. It is important to call in the conservative otologist. A great deal depends on the resistance of the child and the virulence of the infection. Some children on blowing the nose produce infection of the middle ear. Some snuff salt water, which I consider a very dangerous procedure. The mucous membrane of the middle ear is continuous with that of the mastoid cells.

DR. HOLT: I am glad the Society enters a protest against too many mastoid operations. Dr. Pisek spoke of the otologist leaning rather to the side of operation because he felt it was the way of safety, but often operation is the way of danger. In my hospital experience I have seen only one case of meningitis which followed mastoid involvement. That child was operated on on the other side of the Atlantic and came across without having the dressing changed. In my service at the babies' Hospital we constantly have cases of acute otitis — ten or fifteen such are always in the wards in the cold season. We do not have an average of one mastoid a year. We have a conservative otologist on our staff. Dr. Pisek has referred to how often the operation is done among the rich and how relatively seldom among the poor. I agree with him.

DR. WINTERS: Dr. Abt's remarks as to frequency of mastoid operations in European hospitals recalls the statement by Dr. Claude Buchanan Ker in his textbook on Infectious Diseases: "Last year 1,800 cases of scarlet were

treated in Edinburgh City Hospital, and only one operation for mastoid was considered necessary." . . . "I cannot believe Edinburgh patients are any the worse for want of this surgical treatment."

Dr. Holt's statement regarding the infrequency of mastoid operation in the Babies' Hospital recalls the case of Dr. Ferguson's son who had otitis media as a complication of scarlet. Two of the best otologists said the boy must be operated on for mastoid to prevent abscess of the brain. Dr. Ferguson was told neither meningitis nor abscess of the brain ever occurred as a complication of acute otitis media (chronic, yes; acute, never); there is no such case on record. There was no operation. The boy has taken his university degree, his medical degree, and is now an intern in the New York Hospital.

Dr. Abt's statement that he was skeptical about the otologist seeing the membrana tympani well, recalls a boy in the scarlet ward of the Willard Parker Hospital with high temperature. Careful examination eliminated everything but ear. Diagnostic tenderness of the concha made otitis media unequivocal. While this examination was being conducted in the presence of eight students, the otologist walked in. He held a clinic on the boy in the dark room and said the drum membrane was natural and there was no otitis. The same evening, within three hours, the membrana tympani ruptured and there was free discharge of pus on the boy's pillow.

DR. FREEMAN: Had Dr. Southworth known the sort of discussion this paper would elicit he should have invited otologists to defend themselves against the accusations which have been brought against them. The discussion has complicated a matter that is really simple. When an ear drum is red and not bulging, no one, so far as I know, wants to operate on it; while if the drum does bulge no intelligent man should oppose puncture. Mastoid operations are usually a great relief to the attending pediatrist, as bringing to an end a chronic suppuration that needs drainage that can only be afforded by such means. While, like other members, I have a choice among otologists, I believe they are all honest men who are not in any way affected in their advice by the fees they receive for operation.

DR. SMITH: I would like to corroborate what Dr. Freeman has said. I had just recently a case in which the aurist said: "If this case were in the hospital it would be operated upon, but we will not operate just yet." I believe the otologist is quite as conservative about operation as the pediatrician. In my experience the otologist punctures only the drums that bulge, and not others.

DR. CARPENTER: In regard to the prevention of otitis media, I would like to warn against the all too common practice of physicians of making digital examinations of the nasopharynx for adenoids in cases in which there is present any acute inflammatory condition. This dangerous practice may actually cause an infection.

I understood Dr. Southworth to say that in blowing the nose, one side only should be closed. In my opinion neither side should be closed, but if it is necessary to blow the nose at all, both sides should be left open all the while the nose is being blown.

I should like to make a plea for a conservative attitude with regard to early mastoid operation. In mild cases in which there is only slight tenderness, slight swelling and slight fever, I believe the operation is best delayed, if possible, for a week. The wound resulting from the operation heals more quickly than in cases in which operation is performed very early.

DR. CHAPIN: The great difficulty comes in young babies. It is almost impossible in some cases to see the ear drum in small babies. When we cannot see anything we assume that there is nothing there. I believe that many cases are operated on that would get well without operation, but no one seems to be able to say what cases will get well without operation, and we are always ready to throw the responsibility on some one else. Children should be taught to gently blow the nose with the mouth open, thus saving the eustachean tube.

DR. KERLEY: I have had opportunity to see many mastoid operations and I have never seen one in which operation was not warranted by the findings in the mastoid cells. My experience with the otologist is that he is careful in diagnosis and not over zealous to operate. In sinus thrombosis, a blood culture is always made. The results determine whether or not there should be operative procedure. The mastoid operation is not such a terrible operation. A vast majority of patients recover. It may be just as well to open a moderately diseased mastoid and drain posteriorly and thereby avoid adhesions and chronic deafness. I have a feeling that a great many more mastoids are neglected than are opened prematurely.

DR. HESS: In an institution where there are 400 children under 5 years of age, in the last five years we have had four cases of mastoiditis, one case of pneumococcus meningitis following ear trouble, and no case of sinus thrombosis. The plan we have carried out has been to puncture red and bulging ear drums. There is a difference between conservatism in regard to mastoid disease and otitis media which seems to have been lost sight of at times during this discussion.

DR. NORTHRUP: In considering the diagnosis, children may be divided somewhat according to age. The very young children are more likely to get otitis media. During an epidemic of measles one would easily be led to make a diagnosis of otitis media, for when measles is epidemic we are likely to see ear infections. I like to see the specialist abused as much as anybody, but I have no rocks to throw at the otologist. I have a good electric apparatus and I can see the drum, but I fancy there are many not as familiar with the ear drums of young children as the members of this society are. I have had a specialist come to see a patient and have wanted him to operate, and he has persuaded me to wait and within two hours the ear was discharging and I had to send for him again. In my experience I do not find that the otologist is prone to operate. The pediatrician can help by looking out for otitis media during measles. The point for which he should look out especially is whether there is a rise in temperature during measles or pneumonia.

DR. SHERMAN: I would like to say a word for the otologists in Buffalo. They are a conservative lot of men so far as my experience goes. It seems to me that in the prevention of otitis media the one thing is to get back to the lack of immunity; that is the predominating influence as to what will be the extent of the involvement.

There is one other minor point, and that is in reference to treatment and the prevention through the matter of irrigation. We all meet the man who does not irrigate and the man who does irrigate; the one is the dry method, the other the wet method. Both give the same reason for using the method they prefer, namely, that it has done some good. But whether one uses the wet method it has been my experience that the two-way tubes for irrigation are useless. The water does not get through to wash off the waxy secretion or

the loose epithelial cells. If you are going to use the wet method, use something else than the two-way apparatus.

DR. SOUTHWORTH: I have no quarrel with the otologists. There was not a word in my paper that could have been construed as an attack on the otologists. I feel under the deepest indebtedness to them. I agree with Dr. Freeman that every bulging drum should promptly be incised, but some otologists take what they consider the safe side at times and open a red drum before bulging can be detected.

My object in presenting the paper was to stimulate research and discussion, and to determine whether the criteria of the pediatricians differ from those of the otologists.

THE RELATIVE MORBIDITY OF BREAST AND BOTTLE FED INFANTS

H. M. McCLANAHAN, M.D.
OMAHA

It is abundantly established by statistics in all countries that the mortality of bottle fed infants is far greater than among the breast fed. It is also certain that the mortality among bottle fed infants is much less in recent years. It would seem, therefore, a logical conclusion that the morbidity is also greater. Taking them as a whole, it is certainly true that those deprived of the breast have a greater morbidity. The question, however, that suggested itself to my mind in preparing this paper was the relative morbidity between breast fed infants and properly fed bottle infants.

From my personal experience a great majority of infants deprived of the breast are not properly fed. With this in mind I began two years ago making notes of cases under my care of breast and bottle fed infants to determine in my own experience the relative susceptibility of these two classes. In compiling these data I have only included cases that have been continuously under my care. None are included that are now under 6 months of age. The number is not large, as I found I could not include cases seen in the office and be positive of the condition of those children during the entire period. Cases of mixed feeding also were eliminated. While I have under my observation a large number of infants in the Child Saving Institute, I have also excluded these because many of them have partial breast milk and are only there for brief periods. After compiling the series of cases in December, 1917, the thought occurred to me that it would add greatly to the value of the paper to ascertain the views of prominent pediatricians. With this end in view I sent a letter asking the following questions:

1. Your experience as to the relative susceptibility of breast and bottle fed infants.
   (*a*) To contagious and infectious diseases.
   (*b*) To general infections.
2. The relative rate of growth and development (physical and mental) of breast and bottle fed infants.
3. A request for any literature on the subject.

The foregoing letter was addressed to all members of the American Pediatric Society and to thirty-nine other physicians in various sections of the United States engaged in pediatric practice. Seventy answers were received to the questionnaire. Five returned their questions saying they had no opinion to express. Five others were returned stating that the physicians addressed were in the Medical Reserve Corps, U. S. Army. Of the seventy replies, forty-four were received from members of this Society and sixteen from other physicians. These replies were carefully read and divided into two classes:

First, those who answered that breast fed infants are less susceptible to infections.

TABLE 1.—CONDITION OF BREAST AND ARTIFICIALLY FED INFANTS
(DR. GODFREY PISEK'S CASES)

	General Condition				
	Poor	Fair	Good	Excellent	
One hundred cases of breast fed infants (at least to 8 months on breast alone)	22	34	39	5	78 had contagious diseases 58 had colds or pneumonia
One hundred cases of artificially fed infants	23	43	32	3	72 had contagious diseases 48 had colds or pneumonia

Second, those who replied they had not observed any special difference.

In the first group there were 44, and in the second group 16 replies. Before presenting my personal experience I wish to summarize the answers to my questionnaire. Taking up for consideration the 44 affirmative replies, all answered that breast fed infants are less susceptible to general infections, and to many of the specific contagious diseases; 20, however, making an exception of influenza, pertussis, and tuberculosis. Forty answered that the breast fed infants resisted infection better, or that bottle fed infants are sicker.

As to growth, physical and mental, twenty-four answered that the breast fed infants were of better, more even growth, and happier. Eight qualified the statement by saying "during first six months." I have grouped these answers into eight divisions, as many of the replies were almost identical in meaning and language, and I quote from one of each division as follows:

Number 1.—From a clinical experience of forty years, I am of the opinion that bottle fed infants are more susceptible and decidedly less resistant.

Number 2.—I think there can be no doubt that out of an equal number of infants, those who are breast fed are less susceptible to infection than bottle fed infants. The susceptibility to the infections, in my opinion, depends entirely on the state of nutrition.

Number 3.—Breast fed less easily infected, particularly as to scarlatina and diphtheria, etc. Not so as to influenza and pertussis.

Number 4.—Bottle fed infants are likewise more susceptible to general infections. The susceptibility is based on the probable presence of rickets, scurvy, or some deficiency which offers less resistance.

Number 5.—Much less susceptibility among breast fed. The Germans lay great stress on immunity of the breast fed.

Number 6.—My limited experience teaches me that bottle fed children are more susceptible to contagious diseases, because they do not have as great a defensive immunity.

Number 7.—It certainly is true that there are fewer cases of contagious or infectious diseases among breast fed babies than among bottle fed babies. I believe this is due to the breast feeding, since the greatest protection against infections is that the baby is in good general condition.

Number 8.—Cites Rose, who, in his examination of adults, found indications of the absence of breast feeding still discoverable even in adult life.

Taking up for discussion the second group:

Four answered briefly: No difference, without any word of explanation.

Three replied: No difference, excepting the bottle fed are more susceptible to gastro-intestinal diseases.

Two replied: Susceptibility the same, but severity of attack less.

Two replied: No difference, but this premises proper artificial feeding.

Another replied: It is my firm belief, based on observation of private patients, that if the feeding has been proper there is practically no difference after the second year, in the physical and mental growth and development, or in the resistance to infection, in breast and bottle fed children.

Another replied: No difference to infection, but the breast fed has best physical growth during first six months.

Another replied: When breast milk is normal, growth and development are more satisfactory.

TABLE 2.—Review of 700 of Dr. J. P. Sedgwick's Cases

	Three Months			Six Months			Nine Months			One Year		
	56 Cases Breast Fed	13 Cases Art. Fed	14 Cases Mix. Fed	33 Cases Breast Fed	19 Cases Art. Fed	15 Cases Mix. Fed	42 Cases Breast Fed	13 Cases Art. Fed	12 Cases Mix. Fed	266 Cases Breast Fed	99 Cases Art. Fed	112 Cases Mix. Fed
Rickets:												
Number	1	5	0	6	5	2	5	5	6	59	43	36
Per cent.	1.7	38.4	0.0	18.1	26.3	13.3	11.9	38.4	50.0	22.1	43.4	32.1
Impetigo:												
Number	1	0	0	0	0	0	1	0	0	0	0	0
Per cent.	1.7	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0
Eczema:												
Number	4	1	1	7	1	4	4	1	2	21	15	16
Per cent.	7.1	7.6	7.1	21.2	5.2	26.6	9.5	7.6	16.6	7.8	15.1	14.2
Exudative:												
Number	4	1	4	5	2	2	1	0	1	10	7	1
Per cent.	7.1	7.6	28.5	15.1	10.5	13.3	2.3	0.0	8.3	3.7	7.0	0.89
Rhinitis:												
Number	3	3	1	2	3	4	2	1	0	21	7	7
Per cent.	5.3	23.0	7.1	6.0	15.7	26.6	4.7	7.6	0.0	7.8	7.0	6.2
Bronchitis:												
Number	3	0	0	4	2	1	7	3	1	14	12	7
Per cent.	5.3	0.0	0.0	12.1	10.5	6.6	16.6	23.0	8.3	5.2	12.1	6.2
Pertussis:												
Number	2	0	0	0	1	1	5	0	0	13	10	1
Per cent.	3.5	0.0	0.0	0.0	5.2	6.6	11.9	0.0	0.0	4.8	10.1	0.89
Pneumonia:												
Number	2	0	0	1	0	0	2	0	0	6	3	1
Per cent.	3.5	0.0	0.0	3.0	0.0	0.0	4.7	0.0	0.0	2.2	3.0	0.89
Tonsillitis and pharyngitis:												
Number	4	1	0	7	1	0	2	2	2	14	12	7
Per cent.	7.1	7.6	0.0	21.2	5.3	0.0	4.7	15.3	16.6	5.2	12.1	6.2
Grippe:												
Number	4	1	0	2	0	1	2	0	1	21	6	8
Per cent.	7.1	7.6	0.0	6.0	0.0	6.6	4.7	0.0	8.3	7.8	6.0	7.1
Diphtheria:												
Number	0	0	0	0	0	0	0	0	0	3	2	1
Per cent.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.0	0.89
Measles:												
Number	0	0	0	0	1	0	0	0	0	9	6	6
Per cent.	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	3.3	6.0	5.3
Mumps:												
Number	0	0	0	0	0	0	0	0	1	0	1	0
Per cent.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	1.0	0.0
Scarlet fever:												
Number	0	0	0	0	0	0	0	0	0	0	1	1
Per cent.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.89
Chickenpox:												
Number	0	0	0	0	0	0	0	1	1	7	0	2
Per cent.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	8.3	2.6	0.0	1.7
Thrush:												
Number	0	1	1	0	1	1	0	0	0	4	3	0
Per cent.	0.0	7.6	7.1	0.0	5.2	6.6	0.0	0.0	0.0	1.5	3.0	0.0
Pyelocystitis:												
Number	0	0	1	2	0	1	3	0	1	4	5	3
Per cent.	0.0	0.0	7.1	6.0	0.0	6.6	7.1	0.0	8.3	1.5	5.0	2.6
Otitis media:												
Number	1	0	0	1	1	1	0	0	1	10	8	4
Per cent.	1.7	0.0	0.0	3.0	5.2	6.6	0.0	0.0	8.3	3.7	8.0	3.5
Heart murmur:												
Number	1	0	1	1	1	1	1	0	1	8	3	5
Per cent.	1.7	0.0	7.1	3.0	5.2	6.6	2.3	0.0	8.3	3.0	3.0	4.4
Spasmophilia:												
Number	0	0	0	1	1	0	3	3	3	23	7	14
Per cent.	0.0	0.0	0.0	3.0	5.2	0.0	7.1	23.0	25.0	8.6	7.0	12.5
Mental deficiency:												
Number	0	0	0	0	0	0	1	0	0	0	4	0
Per cent.	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	4.0	0.0
Tuberculosis:												
Number	0	0	0	0	0	0	0	0	0	0	0	0
Per cent.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Another replied: No difference in contagious and infectious diseases, but general infections from focal origin in bottle fed more frequent.

Another replied: Bottle fed are sicker, but when properly fed, babies are identical in every particular.

From the foregoing sixteen replies the conclusion is justifiable that the respondents see no marked difference when the infants are properly fed.

Twelve of the sixteen based their conclusions that bottle fed infants are equal to breast fed infants on the premise that they are well or properly fed. This is the crux of the whole question. It would be interesting to know what proportion are properly fed. These replies indicate quite accurately the opinion of those engaged in pediatric practice, and I believe may be accepted as expressing the best thought in the profession. The conclusion is, therefore, that the breast fed infant has greater relative immunity to some of the specific and all of the general infections, and, furthermore, has better resistance when the organism is invaded by pathogenic bacteria. This conclusion suggests the question as to the reason.

Immunity may be defined as that condition of body cells or fluids natural or acquired that enables the body to resist disease. Immunity is, therefore, inherent or natural or acquired. Acquired immunity is established in many ways, as when one attack of a contagious disease affords future protection; also, by vaccination; by the use of protective serums and vaccines, and by age. This phase of the subject, however, does not enter into the present discussion. Inherent or natural immunity is possessed in varying degrees by all infants. They may have a positive immunity to certain specific infections and not to others. Immunity is undoubtedly influenced by heredity, race, climate, environment, age, and the general state of nutrition of the infant.

All infants, irrespective of the method of feeding, seem susceptible to certain of the infections, namely, tuberculosis, pertussis and influenza; less so to others, as scarlet fever and diphtheria. This susceptibility will naturally depend on the inherent immunity of the infant and on its exposure to infection, for without exposure bacterial diseases are not acquired. Does the character of the infant's food influence its susceptibility to infection? Does the breast fed infant have a greater degree of actual immunity? Does the breast milk of certain

mothers confer specific immunity? When the infant's body is invaded by pathogenic organisms, does it resist the invasion more quickly and with less damage to its tissues? The preponderance of evidence is that breast fed infants have a better immunity, and, furthermore, more prompt defense when the invasion occurs. These questions suggest the following reasons for the better defense of the breast fed infant, and may be grouped under two heads.

First, that breast milk contains certain protective substances or antibodies or protective ferments that confer immunity on the infant. The mother's milk may confer immunity by reason of her having had certain of the infectious diseases. Ehrlich, in 1892, was the first authority to draw attention to this subject. Romer, in 1909, asserts that the agglutinins may be carried in the breast milk to the infant. Moro, in 1902, found evidence that the blood of nursing infants contains bactericidal substances derived from the breast milk. These findings are frequently alluded to in textbooks and current literature. Professor Myers of the Bacteriological Department of the University of Nebraska Medical School suggested to the writer experimental work on guinea-pigs, but owing to the faculty being crippled by so many members entering the Medical Reserve, nothing has thus far been attempted. The second reason for the better immunity of the breast fed is due to the fact that human milk as it enters the infant's stomach is warm, sterile, fresh, and contains all of the food elements in a readily utilizable condition necessary to the infant's growth. It seems to be established that breast milk is digested more quickly than cow's milk. For that reason the demand on the cells for secretion of the digestive ferments and enzymes is less and the changes in the proteins and the fats are more quickly accomplished; also, the potential energy of the digested food is more rapidly and completely generated into kinetic energy. The entire process of metabolism is, therefore, simpler because of the conservation of cell activity. For these reasons infants have greater reserve power to resist infection, and more quickly develop defensive antibodies. Intestinal infections are without doubt more rare in the breast fed.

My personal experience with the cases under my care during the two year period may be summarized as follows:

There were 83 bottle fed infants and 67 breast fed. I have had a personal knowledge of all of these infants during the entire period. All resided in Omaha or the immediate vicinity. I have seen these

infants at frequent intervals when well, and always during any sickness. All were under the same general environment. The average social standing of the bottle fed infants was higher than those of the breast fed. The bottle fed group had the advantage so far as good nursing, protection from exposure and proper care have an influence. Naturally, the exposure to the contagious diseases varied in the individual bottle fed cases. All of the bottle infants were fed on modified milk. No set formula was used. Indeed, scarcely any two received the same formula. I make it a rule to use as high a percentage of fat as the infant's digestion will tolerate, but begin feeding with a low percentage until the digestive capacity is ascertained. All of the bottle fed infants received orange juice. At the age of 6 months

TABLE 3.—Data of Author's Cases

	Breast Fed, 63 Cases	Result	Bottle Fed, 79 Cases	Result
Bronchopneumonia	3	Fatal (comp. grip)	9	7 recovered; 2 fatal
Grip	11	10 recovered; 1 fatal (comp. otitis media and purulent men.)	21	Recovered
Pertussis	5	Recovered	6	Recovered
Varicella	3	Recovered	6	Recovered
Measles	6	Recovered	10	1 fatal (comp. bronchopneumonia); 9 recovered
Diphtheria	0		1	Fatal
Miliary tuberculosis	0		1	Fatal
Tuberculous meningitis	0		1	Fatal
Intestinal indigestion	4	Recovered	16	Recovered
Enterocolitis	0		4	Recovered
Scarlet fever	0		2	Recovered

all received cereal in some form, and many had the cereal gruel as a diluent at a younger age. In nearly all cases certified milk was used, but in 14 cases pasteurized milk proved to be more digestible. During the two year period there were 5 fatal cases, a mortality of 7¼ per cent. One death occurred from diphtheria at the age of 10 months, two from bronchopneumonia at the age of 7 and 11 months, one from miliary tuberculosis at the age of 5 months, one from tuberculous meningitis at the age of 20 months. This was the only fatal case during the second year of life. During the two summers, 20 of the infants suffered from digestive disturbances. Sixteen of these were simply cases of fermentative or putrefactive diarrhea. In these cases the milk was withdrawn with the beginning of symptoms and all recovered within a week. Four of the infants developed severe enterocolitis, one of the number having a very protracted illness. Altogether,

there were 9 cases of bronchopneumonia, three of these complicating measles, one terminating fatally. Another case of bronchopneumonia complicating grip terminated fatally. There was one case of typical lobar pneumonia. There were 10 cases of measles, all patients recovering except one complicated by bronchopneumonia. All of these cases occurred in families where older children were suffering from the disease. There were 6 cases of varicella, also 6 cases of pertussis. There were 2 cases of scarlet fever, both children recovered. During the two years there were 21 cases of grip, and 5 of these were complicated by otitis media, 3 by suppurative cervical adenitis, 3 complicated by bronchopneumonia one terminating fatally. It is but fair to state that diphtheria and scarlet fever were not endemic in Omaha during the observation period. Seventy-seven of the group are now livinng. Seventy-two of this number have made satisfactory gain in weight and are normal infants in every physical and mental development. Of the 5 infants living but not in good condition, two I have classed as difficult feeding cases or milk idiosyncrasies, one is a Mongolian, and two had hereditary lues and are still under treatment.

Second, there were 67 breast fed infants and two fatal cases during the two year period, one with bronchopneumonia complicating a severe grip and the other having first grip complicated by otitis media, this followed by a purulent meningitis as proved by lumbar puncture. All infants receiving breast milk six months longer are included in this group. Forty-nine had no complemental feeding during the first six months. Eighteen under 6 months received one or more bottles daily. After 6 months all of the infants had one or more bottles a day. Eleven of the breast fed infants suffered from grip in a severe form, all occurring in families where this disease prevailed among older members. There were five cases of whooping-cough. All the breast fed infants with known exposure acquired the disease and all recovered. The youngest patient developed a distinct whoop when 20 days old, an older child in the family having the disease at the time of its birth. Three of this group had varicella, 6 had measles, 3 had bronchopneumonia, one terminating fatally. There were no cases of scarlet fever or diphtheria among the breast fed; however, scarlet fever occurred in older children in three of the families. There were no cases of severe intestinal disease among the breast fed during the first year and no severe cases during the second year. There were other diseases in both groups that I have not taken

into account because I could not class them under the head of infections. Eczema occurred in both classes, constipation required attention in both groups.

Two of the respondents furnished me with data that I am permitted to use: Dr. Godfrey Pisek of New York, whose table will be found attached, and Dr. J. P. Sedgwick of Minneapolis, who furnished me a very elaborate table, carefully compiled and comprehensive, giving the results in 700 cases. These, with a table of my own cases, are set forth.

SUMMARY

1. The superiority of breast milk may be due to chemical and biologic differences which render it more readily usable by the infant. As a result it has a more natural energy which it can apply to the invading organisms.

2. Breast milk may contain natural antibodies or protective ferments, both specific and nonspecific.

3. Breast fed infants are less susceptible to infections, the two exceptions being influenza and tuberculosis.

4. Breast fed infants resist infection more quickly and with less injury.

5. The breast fed infants have less morbidity than properly fed bottle infants, while the larger group of badly fed infants have had a still greater disadvantage.

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DISCUSSION

Dr. Herrman: Dr. Holt suggested to the New York City Health Department that they study this subject, and in February, 1916, they began to collect material. The figures have not been tabulated, but I have discussed the matter with Dr. Sobel, who is conducting the investigation. He started with 1,800 cases, but as the people move from place to place, many could not be followed to the present time and he has been able to tabulate only about 800 of them. This work is not complete, but as far as they have gone it is questionable whether they are going to be able to prove that after the first year of life, bottle fed babies have a higher morbidity than breast fed infants. It is one thing to have an impression and another thing to prove it scientifically in an investigation of this kind. There was a similar investigation made in England, and the results do not prove conclusively that the breast fed infants were less susceptible and had more resistance than bottle fed babies. It is a question whether it is possible to collect data that will prove it conclusively. I have been interested in studying the problem of immunity to measles in large cities. It is a fact that children, under 5 months, in large cities are relatively immune to

measles, and there is practically no difference between breast fed and bottle fed babies, because the immunity is not conveyed through the breast milk, but through the placental circulation from a mother who has had measles. We also know that in 1916 poliomyelitis attacked the breast fed baby with the same regularity as it did the bottle fed baby. My impression is that the resistance of the breast fed baby is greater, but it is difficult to prove the fact so conclusively that the evidence cannot be objected to in some way.

ASCENDING INFECTION OF THE URINARY TRACT

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The exact route by which an infection travels from the bladder to the ureters, pelvis and kidney substance is still an open question. The routes by which this infection may take place are: (1) By way of the bladder lymphatics to the lymphatics of the ureter and kidney; (2) by direct extension through the wall of the bladder and the ureter; (3) by direct extension up the lumen of the ureter, and (4) by way of the blood stream.

A brief review of the literature shows that a single injection of bacteria into the bladder rarely leads to infection of the upper urinary tract unless there is some injury to the bladder. Kretchmer[1] has shown in some observations on the bladder of children that regurgitation of the bladder contents into the ureter does occasionally take place. Bauereisen[2] has shown both histologically and experimentally that in tuberculosis, at least, the production of an infection by direct extension through the wall of the bladder and ureter is a possibility. A great deal of work has been done on the lymphatics of the bladder, ureters and kidneys, showing very definite anastomosis between the different portions of the bladder, ureters and kidneys. Furthermore, anastomosis between the peri-ureteral lymphatics and those of the submucosa and muscularis has been demonstrated. Sweet and Stewart,[3] in their work on the transplantation of ureters into the intestinal wall, were able to demonstrate that the infection travels up the ureteral lymphatics to the kidneys. Their work, however, does not prove that urinary tract infection through the lumen of the ureter may

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*From the Otho S. A. Sprague Memorial Institute Laboratory of the Children's Memorial Hospital.

1. Kretchmer: Cystography, Surg., Gynec. & Obst. **22**:209, 1917.

2. Bauereisen: Beitrag zur Frage der Aszendierenden Nieren-tuberculose, Ztschr. f. Gynäk. u. Urol. **2**:132, 1910. Idem.: Ueber die Lymph gefaesse des Menschlichen Ureters, Arch. f. Gynäk. u. Urol. **2**:235, 1910. Idem.: Ztschr. f. Gynäk. u. Urol. **4**:124 (1913).

3. Sweet and Stewart: Ascending Infection of the Kidneys, Surg., Gynec. & Obst. **18**:460, 1914.

not occur without involvement of the lymphatics. David,[4] in his article on ascending urinary infections, calls particular attention to the fact that peri-ureteral and pelvic infiltration is not synonymous with infection of the urinary tract. This applied particularly to the work of Eidrendrath and Kahn and Eisendrath and Schultz.[5] They demonstrate periureteral infiltration but no involvement or inflammatory reaction within the pelvis or the presence of bacteria there. Cabot and Crabstre,[6] in a series of cases, were able to demonstrate the presence of colon bacilli in the blood before the acute onset of a pyelitis.

As David rightly points out, a good deal of work has been done without being properly controlled. The bacteriology of the urinary tract previous to experimentation has not been studied. The same is true of postmortem examinations in which the bacteriologic work is very scanty. Inasmuch as the work of David is perhaps the most complete and best controlled contribution on the subject, I will go at some length into a discussion of this work. His experiments were controlled by removal of a portion of the ureter just prior to the establishment of the experimental conditions, and urinary cultures were made in all cases. The technic employed was as follows: By incision through the abdominal wall, the right ureter was divided about 1 inch above the bladder. A piece was removed and the proximal stump of the ureter ligated. The bladder was then injected, either through the distal ureteral stump or by means of a needle through the wall of the bladder. The point of injection was then closed with a pursestring suture.

In seven dogs having unobstructed, nontraumatized bladders two had positive cultures in the bladder, left ureter and pelvis, with absence of any cellular infiltration of any of the tissues, and with sterile blood and sterile right hydronephrosis. In three dogs of the same series, in which there was a gross fibrinous exudate on the peritoneal surface of the bladder, the culture from the left ureter, left pelvis and blood were negative. There was, however, peri-ureteral infiltration, diminishing as the pelvis was approached. On the right side in all three of these

4. David: Ascending Urinary Infections, Surg., Gynec. & Obst., **26**:159, 1918.

5. Eisendrath and Kahn: The Rôle of the Lymphatics in Ascending Renal Infection, J. A. M. A. **66**:561, 1916. Eisendrath and Schultz: The Path of Involvement in Ascending Infection of the Urinary Tract, J. Med. Research **25**:295.

6. Cabot and Crabtree: Nontuberculous Renal Infections, Surg., Gynec. & Obst. **23**:495, 1916.

cases, despite a defect in the ureter, a definite infiltration with polymorphonuclear cells was found which became most intense in the fat about the pelvis. In only one of these three was the lumen of the pelvis infected, however. These five experiments show first of all that peri-ureteral and peripelvic infiltration does not of necessity mean infection of the lumen of the pelvis and ureter, and, secondly, the first two experiments prove that infection may travel by way of the ureteral lumen from the bladder to the pelvis.

To sum up the experiments of David, those with an unmolested flow, as well as those with a partially checked flow, it may be said that in eleven experiments on the right side in which a portion of the ureter was removed there was peri-ureteral and peripelvic infiltration with sterile urine in ten out of eleven cases. On the left side in which the urine was intact, there was peri-ureteral and subpelvic exudate in only four instances, but there were positive cultures of colon bacilli grown from the left ureter and left pelvis of the kidney in ten out of eleven experiments. With the controls used by David from the blood stream and cultures from the right hydronephrosis, the conclusion that he deduces, namely, that infection on the left side ascends from the bladder to the pelvis by way of the lumen of the ureter, seems to be justified. These experiments prove that in the experimental animal, at any rate, infection can travel by way of the lumen of the ureter from the bladder to the pelvis of the kidney.

The work that I wish to report consists of a series of rabbits that were infected by the injection of a pure culture of colon bacillus, isolated from a spontaneous case of pyelitis in the rabbit. The technic was as follows: The animals were catheterized, and after catheterization 5 c.c. of a broth culture of colon bacilli were allowed to flow into the bladder by gravity. The urine was controlled microscopically and by culture and only those animals were used that showed negative urine. In a series of 32 intracystic injections, 15 of the animals showed definite pyelitis. Of this entire series of animals, only one showed abscesses in the kidney. These were in small groups in both kidneys, differing thereby from the abscesses that are obtained by intravenous injection, which are usually diffusely scattered throughout the kidney substance. The presence of a pyelitis was controlled both bacteriologically and histologically. The gross appearance was usually about as follows: On opening the peritoneal cavity the bladder was usually only very slightly distended with urine. The peritoneum about the

bladder was edematous. The edema frequently extended up a short distance on the ureter. In a few instances there was a slight swelling of the ureter and an injection of the vessels of the ureter. In the marked cases of pyelitis the pelvis was definitely distended with pus.

The histology of the organs was roughly as follows: Bladder: There was usually a definite marked acute inflammatory reaction in the submucosa and, in many instances, extending throughout the thickness of the bladder wall. So much can be said for all of the animals. The histology of the ureters and kidneys can be roughly grouped into two classes: those in which there are definite evidences of ureteral and peri-ureteral infiltration and infection of the pelvis, and second, those in which the findings in the ureters and kidneys were practically only pus in the pelvis of the kidney. In the first group there were five instances and in the second ten.

In all probability there were two routes by which the infection of the pelvis was accomplished: (1) by way of the lymphatics; (2) by direct extension up the lumen of the ureter. From the work of David it of course is difficult to say whether we might not have the pyelitis develop by direct extension up the lumen and have at the same time peri-ureteral inflammation. The extent of this inflammatory reaction, differing very markedly from that described by Eisendrath and Schultz, in that it was always of polymorphonuclear character, makes it seem probable that in those instances in which the acute infiltration extended to the lumen of the pelvis the infection traveled by way of the lymphatics rather than by way of the lumen.

As a control, the kidneys of a rabbit that were intravenously injected were studied to see what the relationship of the pelvic and peri-ureteral inflammation was. The inflammation in practically all of these was limited to the papilla side of the pelvis, and in no instance did we find such gross inflammatory reactions about the parietal wall of the pelvis as was the case in the intracystic injections.

To summarize:

1. With intracystic injection in fifteen out of thirty-two cases, pyelitis was produced in the rabbit.

2. The histology of the lesions would indicate that: (*a*) the infection travels by way of the lymphatics from the bladder to the ureter to the kidney; (*b*) in other instances it may probably travel by way of the lumen of the ureter.

A PROTECTIVE THERAPY FOR VARICELLA, AND A CONSIDERATION OF ITS PATHOGENESIS

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As is well known, chickenpox is one of the very mildest of the infectious diseases to which children are subject. It possesses, however, considerable medical interest, as one of the group of diseases of unknown origin, and furthermore, because of its remarkable communicability. In the latter particular it is rivalled only by measles. In the Home for Hebrew Infants it has been our experience that in the course of an epidemic about three quarters of the younger children develop varicella, and about one half of those above 2 years of age. It spreads rapidly through the institution, progressing from ward to ward in an uncontrollable manner, frequently necessitating quarantine for a period of many months. Among children in private homes it possesses a serious pedagogic aspect, often disrupting the school sessions for long periods because of its widespread prevalence and long incubation period, which causes the infection to drag along throughout the entire winter term. Therefore, when Kling,[1] in 1913, reported that he was able to immunize children against this mild but exceedingly disturbing infectious disease by means of a single vaccination, we welcomed the announcement and decided to make use of it at the earliest opportunity. Kling's method consisted merely of applying the contents of the vesicles to the abraded surface of the skin, after the manner in which a von Pirquet tuberculin reaction is carried out. Two years later a small epidemic of chickenpox made its appearance in our institution and Kling's method was put into practice. The result may be summarized by the statement that it afforded a certain degree of immunity, but that it was by no means satisfactory. This, we believe, has been the experience of others who have used this procedure. It seemed to point the way, however, to better methods. It was evident, from its partial success, that the virus was contained in the vesicles, and it seemed probable that its failure was due to a faulty and uncertain introduction of the virus.

1. Kling, C.: Berl. klin. Wchnschr., 1913, **50,** 2083.

During the past year varicella has been widespread throughout New York City, and made its appearance in our admitting pavilions. An opportunity was therefore afforded us again to attempt immunization. To this end we made use of the contents of the vesicles, but instead of applying this fluid to the surface of the skin, we injected it intravenously. The technic was as follows:

In each instance only vesicles, and not pustules, were made use of; the surfaces were very gently washed with sterile salt solution and the contents allowed to ascend into capillary tubes. As much as possible of the clear fluid was obtained and was immediately mixed with sterile normal salt solution. This diluted virus was diluted still further with salt solution before it was injected. The dosage was entirely empirical, ¾ inch, as measured in the capillary tube, was used in each instance.[2]

In all, thirty-eight children, about 3 or 4 years of age, were vaccinated intravenously after this method. None of the children developed any local or general signs, or any eruption suggestive of varicella. They were all, in the course of the epidemic, unavoidably in contact with one or more cases of chickenpox, but in spite of this proximity only one developed the disease, this one thirty-six days after the date of inoculation.

It is evident, therefore, that by means of these intravenous vaccinations almost absolute immunity was brought about, and no symptoms of the disease. This result, paradoxical as it may at first appear, may be interpreted as follows: It would seem that most viruses are able to bring about their specific diseases only when they are introduced in their natural paths, or rather, that if they are introduced by other routes, an excessive amount of the virus is required to produce a specific reaction. Varicella, a disease of the lymphatic system, does not enter the body by means of the blood stream, and its virus has not acquired the property of invading the human organism by this path. It was this line of reasoning which led us to undertake this mode of therapy.

Camus[3] found, in his experiments on smallpox, that it required a very much larger amount of variola virus to produce this disease in rabbits when the intravenous, instead of the cutaneous, method was

2. All children in the institution who have a large spleen, bilateral epitrochlear glands, or give a family history of insanity, are subjected to the Wassermann test, so that all danger of syphilis was guarded against.

3. Camus, L.: Compt. rend. Soc. de biol., 1913, **75**, 344.

employed, and recently Noguchi[4] noted a similar phenomenon in experimenting with his testicular virus. The latter reports that in order to produce an eruption one thousand times more virus had to be introduced by way of the blood stream than applied on the skin. It is interesting to note in this connection that Noguchi showed that the lymph glands harbored the virus; this may likewise hold true for varicella.

The vesicular lymph was given also in other ways, as will be seen by consulting Table 1. It will be noted that in a number of cases it was introduced intravenously after having been inactivated by exposure to a temperature of 56 C. for three quarters of an hour. In sixteen instances the unheated lymph was injected intracutaneously; in ten, subcutaneously, and in a few cases was placed on the broken skin, on the mucous membrane of the nose, on the tonsils and buccal mucous membranes, and on the mucous membranes of the nose and mouth.

It seemed as if these methods might afford a simpler technic, and one which would avoid the somewhat difficult intravenous puncture. It will be seen from the table, however, that the number of these cases which came into intimate contact with the varicella were too few to allow us to judge of the success of these attempts at vaccination. Two facts, nevertheless, stand out in sharp relief: first, that no instance of primary varicella, even of the mildest type, resulted from these attempts at immunization and, second, that only the intravenous method was shown to afford adequate protection. The latter conclusion is inevitable in view of the fact that chickenpox developed about two months later in one of the three cases in which the lymph was placed on the broken skin (von Pirquet), and in two of the three cases in which it was applied to the nostrils. These few tests suffice to show the inefficacy of these simpler methods.

About three years ago Herman[5] made an attempt to immunize infants under 6 months by applying to the nostrils nasal mucus from children having measles. He carried this out in forty cases and believed that he had brought about immunity in a certain number of instances. In the light of this report, and its simplicity, it seemed worth while to make a similar attempt on a small number of cases in relation to varicella. In view of the fact that the vesicular lymph, which is known to contain the varicella virus, did not induce the slight-

4. Noguchi, H.: Jour. Exper. Med., 1918, **27,** 425.
5. Herman, C.: Arch. Pediat., 1915, **32,** 503.

est disorder when applied this way, it was evident that no disturbance was to be apprehended from this procedure. In three instances the nasal secretion of varicella patients was applied to the nostrils; in three others the tonsillar secretion to the tonsils, and in six, the tonsillar and pharyngeal secretions were transferred to the nose, the pharynx, and the tonsils. In none of these twelve cases was there any reaction whatever, either local or systemic. In two, secondary varicella developed in the course of the epidemic, from six to eight weeks later — one, where the nasal secretion was employed, and another where the tonsillar secretion was made use of. It is therefore evident that this method cannot be relied on to bring about protection. This is all the more striking in view of the fact that of these twelve cases only six came in intimate contact with varicella, so that we must consider that two of the six failed to develop immunity to the disease.

SUMMARY OF PROTECTIVE IMMUNIZATION

Mode of Introduction of Lymph	Number of Cases*	Number Subsequently in Contact with Chickenpox	Number of Contacts Developing Chickenpox	Remarks
Intravenous	38	38	1	Chickenpox appeared in this case 41 days following prophylactic therapy
Intravenous (inactivated)	9	1	0	
Intracutaneous	16	5	1	No local reaction
Subcutaneous	10	0	—	
Skin (v. Pirquet)	3	3	1	Chickenpox 62 days after immunization
Nostrils	3	3	2	Chickenpox 44 and 62 days after immunization
Tonsils and mouth	3	3	0	
Tonsils, nose and mouth	4	0	—	

* There was no instance of signs or symptoms of varicella occasioned by the immunization.

Incidentally, these tests furnish interesting information as to the portal of entry of the virus of varicella. The fact that the lymph from the vesicles, when applied to the broken skin or to the mucous membranes, led to no infection must cause us to consider this investigation from quite another standpoint. How are we to explain this lack of infectivity of the contents of the vesicles, which are generally regarded as the source of infection, and are used as the criterion in prescribing the duration of quarantine? There seems to be but one logical inter-

pretation of these results, namely, that the lymph was in no instance applied to its natural portal of invasion. The only other possibility—that the virus is not present in the vesicle—is apparently refuted by our experience that immunity was brought about by injections of this fluid. What is, then, Nature's path of invasion? These vaccinations afford strong testimony — of a negative character, it is true — for an answer to this question. In view of our results, and the highly infectious nature of this disease, we are led to the tentative conclusion that the virus is air borne, and that its portal of entry frequently is the respiratory tract.

CONCLUSIONS

It is possible to bring about immunity to varicella by means of an intravenous injection of the contents of the vesicles. In thirty-eight instances in which this was carried out it failed to protect in only one case. Vaccinations of this kind induce neither local nor systemic reaction. The acquisition of immunity likewise indicates that the specific virus is contained in the vesicles. A simpler method of therapy, the application of the lymph to the broken skin or mucous membranes, failed to bring about satisfactory immunity, although it also occasioned no disorder.

These investigations have a secondary bearing as to the natural portal of entry of the varicella virus into the body. As we can exclude the skin and the mucous membranes in this connection, it would seem most probable that the virus enters by way of the respiratory tract, and that contagion comes about through the air. This mode of infection would account for the almost unexampled communicability of this disease.

16 West Eighty-Sixth Street.

DISCUSSION

DR. TALBOT: Since we do not know how the virus of varicella is transmitted, I would like to know, in the first place, how Dr. Hess knew that the thirty-eight cases were exposed to varicella. In the second place, how many children as controls had the same exposure? It is a very interesting subject, but I do not feel convinced that the point has been proved as yet.

DR. HERRMAN: Is Dr. Hess certain that the children who were immunized and did not contract the disease had never had chickenpox? These children were not born in the institution, so that it is very difficult to obtain an accurate previous history. Dr. Hess says that the infection probably takes place through the respiratory tract; and still when the virus was applied to the nasal mucous membrane the disease was not produced and the children were not successfully immunized.

DR. HESS: What is meant by the thirty-eight children coming in contact with chickenpox is that they were in a ward where there was chickenpox on some two or three different occasions. Only one case of chickenpox developed In our experience with young children about two-thirds of them get chickenpox. In the older children about one-half take the disease when they come in contact with it as these children did. It is perfectly possible that some of these children previously had chickenpox, but we had a history in all the cases, and we looked for pox marks in every case. Possibly a few had had the disease, but the number that contracted the disease after exposure was striking in comparison to the number that usually develop the disease.

Dr. Herrman stated that antibodies were probably not formed, as there was no febrile reaction. There is not a great febrile reaction in the course of the disease, so that if antibodies are formed it is scarcely to be expected that the reaction would be sufficient to cause fever. The suggestion that the portal of entry is through the respiratory tract is based on indirect evidence, and is therefore tentative.

COMPARISON OF THE CARBON DIOXID TENSION OF THE ALVEOLAR AIR AND THE HYDROGEN-ION CONCENTRATION OF THE URINE WITH THE BICARBONATE OF THE BLOOD PLASMA *

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During the past two years data have been obtained from normal infants and from infants suffering from acidosis which permit a comparison of the carbon dioxid tension of the alveolar air, and the acidity of the urine with the plasma bicarbonate.[1]

TECHNIC

Alveolar air was collected by the Plesch-Higgins method as modified by Howland and Marriott. A large number of the analyses were made by the Haldane apparatus, the remainder by the colorimetric method of Marriott.[2] We have found the latter method to be quite accurate when carefully used and the results vary but little from those obtained by the Haldane apparatus. It seemed evident that any errors inherent in the colorimetric method were less than those associated with the method of collection of the alveolar air.

The plasma bicarbonate was determined by the method of Van Slyke and Cullen;[3] corrections for temperature and barometric pressure were made from their table.

Hydrogen-ion concentration of the urine was determined by the method of Henderson and Palmer.[4]

When the alveolar air and the plasma bicarbonate were compared, the alveolar air was collected first and the blood withdrawn within a few minutes. When crying occurred during the air collection the infant was quieted and kept so for a few minutes before the blood was taken. The blood was withdrawn from the superior longitudinal sinus by means of a syringe, care being taken to prevent the entrance of air. By means of a glass tube and rubber attachment applied directly to the syringe, the blood was transferred under-

* From the Children's Wards, Bellevue Hospital, Dr. L. E. La Fétra, Director, and the Pathological Laboratory, Bellevue Hospital, Dr. Douglas Symmers, Acting Director. This work was aided by a grant from the Rockefeller Institute for Medical Research.

1. All cases of acidosis considered in this paper were of the variety due to gastro-enteric disorders.

2. Marriott, J. McK.: J. A. M. A. **66**:1594, 1916.

3. Van Slyke, D. D., and Cullen, G. E.: J. Biol. Chem. **30**:289, 1917, their table.

4. Henderson, L. J., and Palmer, W. W.: J. Biol. Chem. **17**:305, 1914.

neath a layer of mineral oil in a centrifuge tube, contact with the air thus being entirely avoided. By these precautions the values obtained were for venous blood and could therefore accurately be compared with the carbon dioxid tension of alveolar air collected by the Plesch-Higgins method.[5]

Comparison of the hydrogen-ion concentration of the urine and the plasma bicarbonate was effected as follows: The infant was placed on a metabolism frame and the urine collected for four hours. At the end of two hours, blood was withdrawn for the determination of the plasma bicarbonate.

COMPARISON OF PLASMA BICARBONATE WITH CARBON DIOXID TENSION OF ALVEOLAR AIR

Normal Infants. — The plasma bicarbonate of normal infants[6] ranged from 49 to 72 volumes per cent. of carbon dioxid bound as bicarbonate at 0° and 760 mm. barometric pressure. These values are lower than those for normal adults.[7] The carbon dioxid tension of alveolar air varied from 34 to 45 mm. of mercury. The carbon dioxid tension of alveolar air and the plasma bicarbonate of normal infants are shown in Table 1.

$$\frac{\text{The plasma bicarbonate } (CO_2, \text{ V. P. C.})}{CO_2 \text{ tension of alveolar air}}$$

ranges from 1.22 to 1.84 with an average value of 1.5. The factor by which the carbon dioxid of the plasma bound as bicarbonate must be multiplied to convert it into terms of carbon dioxid tension of alveolar air is $\frac{1}{1.5} = 0.66$. The close correspondence between the direct determination of the carbon dioxid tension of alveolar air and its calculation from the plasma bicarbonate is shown in Table 1. It is of considerable interest that the factors 1.5 and 0.66 are identical with those which apply to adults.[7] There has always been some question as to the accuracy of the collection of alveolar air from infants. The fact that the air is collected for a definite time, despite the rapidity and amplitude of respiration, suggests a possible source of error. Our results, however, indicate that in normal infants the collection of alveolar air by the Plesch-Higgins method as modified by Howland and Marriott gives an accurate index of the plasma bicarbonate.

Infants with Small Tidal Air Volume.—The accuracy of the collection of a sample of alveolar air from infants is dependent to some

5. This method gives the carbon dioxid tension of venous blood.

6. All of the patients on whom investigations were conducted were under 18 months of age.

7. Van Slyke, Stillman, and Cullen: J. Biol. Chem., **30**:401, 1917. Gettler and Baker, J. Biol. Chem. **25**:211, 1916.

degree on the manner in which the infant breathes. This fact has been pointed out by Marriott. With a little experience one can tell almost exactly whether the air collection is satisfactory. In very small

TABLE 1.—COMPARISON OF THE TENSION OF CARBON DIOXID IN ALVEOLAR AIR WITH THE PLASMA BICARBONATE IN NORMAL INFANTS

Case No.	CO_2 Tension of Alveolar Air, Mm.	Plasma Bicarbonate. CO_2 Bound at 0° and 760 Mm., Volume per Cent.	Plasma Bicarbonate. Volume per Cent. of CO_2 Bound at 0° and 760 Mm. CO_2 Tension of Alveolar Air, Mm.	Plasma Bicarbonate. (Volume per Cent. CO_2) × 0.66 to Give CO_2 Tension of Alveolar Air, Mm.
1	38.0	61.7	1.62	40.7
2	35.0	52.1	1.49	33 9
3	37.5	52.1	1.39	34.4
4	34.0	59.5	1.75	39.2
5	34.0	49.8	1.46	32.9
6	37.0	55.6	1.50	36.8
7	40.0	49.0	1.22	32.4
8	45.0	71.0	1.58	46.8
9	38.0	54.0	1.42	35.6
10	39.0	59.7	1.61	39.4
11	38.0	52.2	1.37	33.9
12	32.5	51.8	1.60	34.2
13	38.0	59.7	1.57	39.4
14	40.0	61.3	1.53	40.5
15	41.5	60.4	1.45	39.9
16	39.8	61.9	1.55	40.9
17	36.3	51.2	1.41	33.9
18	44.1	73.2	1.65	48.2
19	40.6	60.0	1.48	39.6
20	39.0	71.7	1.84	47.3
21	43.2	58.6	1.38	38.6

infants whose tidal air volume is small, or sick infants with shallow respirations, the analysis of alveolar air may be very misleading. The results from a group of such infants are shown in Table 2.

It is quite evident that a consideration of carbon dioxid tension of alveolar air alone would have led to the diagnosis of acidosis, while the plasma bicarbonate showed that none existed. The reason for this

error is obvious. The tidal air volume is so small that but little air enters the bag, most being taken up by the dead space in the mask. The air withdrawn from the bag for analysis contains a large proportion of atmospheric air. In practically every case shown in Table 2 it was realized at the time the test was made that the collection of alveolar air was unsatisfactory, and that the results would be too low.

TABLE 2.—COMPARISON OF TENSION OF CARBON DIOXID IN ALVEOLAR AIR WITH PLASMA BICARBONATE IN INFANTS WITH SHALLOW RESPIRATION

Case No.	CO_2 Tension of Alveolar Air, Mm.	Plasma Bicarbonate. CO_2 Bound at 0° and 760 Mm., Volume per Cent.	Plasma Bicarbonate. (Volume per Cent. CO_2) × 0.66 to Give CO_2 Tension of Alveolar Air, Mm.	Difference Between Determined CO_2 Tension of Alveolar Air and CO_2 Tension of Alveolar Air Calculated from Plasma Bicarbonate
1	24	51.3	33.8	9.8
2	25	....	45.5	20.5
3	30	63.5	42.0	12.0
4	22	54.0	35.3	13.3
5	16	48.0	31.3	15.3
6	21	53.0	35.0	14.0
7	26	62.0	41.5	36.0
8	27	58.0	38.0	11.0
9	22	56.0	37.0	15.0

From these results it seems evident that the carbon dioxid tension of alveolar air and the plasma bicarbonate correspond closely only in infants whose tidal air is of moderate volume. In infants with shallow respirations, the alveolar air may lead to the diagnosis of acidosis when none exists. In such cases the plasma bicarbonate must be used as a guide or a mask devised which has a smaller dead space.

Infants Suffering from Acidosis.—The results from cases of acidosis are given in Table 3. They show a fairly close correspondence between the alveolar air and the plasma bicarbonate. This, however, is true only before the administration of sodium bicarbonate. In Table 4 is shown results from a group of infants who had been given a sufficient amount of sodium bicarbonate to restore the alkaline reserve. In many of the cases the alveolar air analysis showed results which were too low despite the correction of acidosis. It seems that

TABLE 3.—Comparison of Tension of Carbon Dioxid in Alveolar Air with Plasma Bicarbonate in Infants with Acidosis

Case No.	CO_2 Tension of Alveolar Air, Mm.	Plasma Bicarbonate. CO_2 Bound at 0° and 760 Mm., Volume per Cent.	Plasma Bicarbonate. (Volume per Cent. CO_2) × 0.66 to Give CO_2 Tension of Alveolar Air, Mm.	Difference Between Determined CO_2 Tension of Alveolar Air and CO_2 Tension of Alveolar Air Calculated from Plasma Bicarbonate
1	14	32.6	21.8	7.8
2	23	37.3	24.6	1.6
3	28	39.1	25.8	2.2
4	17	24.3	15.0	2.0
5	19	22.3	14.6	4.3
6	22	21.4	14.1	7.9
7	26	37.3	24.6	1.4
8	20	41.1	27.1	7.1
9	17	25.4	16.75	0.25
10	26	44.8	29.6	3.6
11	23	39.1	25.8	2.8
12	20	36.0	23.8	3.8
13	26	48.1	31.7	5.7
14	31	41.6	27.4	3.6
15	22	35.4	23.4	1.4
16	28	45.7	30.1	2.1
17	20	22.3	14.7	5.3
18	26	43.0	28.4	2.4
19	26	48.4	31.9	5.9
20	24	42.4	27.3	3.3
21	25	44.3	29.2	4.2
22	11	14.4	9.5	1.5
23	22	37.0	14.5	7.5
24	18	19.7	13.0	5.0
25	19	39.1	25.8	6.8
26	28	33.0	21.8	6.2
27	27	38.5	25.4	2.4
28	28	42.4	28.0	0.0
29	33	50.1	33.1	0.1
30	18	26.4	17.4	0.6
31	20	39.6	26.2	6.2
32	24	36.0	23.8	0.2
33	20	30.9	20.4	0.4

the respiratory center may remain hyperirritable after the correction of acidosis. Whether this is a direct result of the disease, or whether the respiratory center is capable of stimulation by conditions other than an increased hydrogen-ion concentration of blood, remains to be determined.

TABLE 4.—COMPARISON OF CARBON DIOXID TENSION OF ALVEOLAR AIR WITH PLASMA BICARBONATE IN CASES OF ACIDOSIS AFTER CORRECTION OF THE ACIDOSIS

Case No.	CO_2 Tension of Alevolar Air, Mm.	Plasma Bicarbonate. CO_2 Bound at 0° and 760 Mm., Volume per Cent.	Plasma Bicarbonate. (Volume per Cent. CO_2) × 0.66 to Give CO_2 Tension of Alveolar Air, Mm.	Difference Between Determined CO_2 Tension of Alveolar Air and CO_2 Tension of Alveolar Air Calculated from Plasma Bicarbonate	Sodium Bicarbonate, Gm.
2 (a)	23	37.3	24.6	1.6	6.0 subcutaneously
(b)	29	55.0	36.1	7.1	
5 (a)	17	24.3	15.0	2.0	5.4 subcutaneously
(b)	23	57.2	37.1	14.1	
14 (a)	23	39.1	25.8	2.8	7.0 intravenously
(b)	37	60.3	39.8	2.8	
17 (a)	20	36.0	23.8	3.8	6.6 subcutaneously
(b)	28	72.0	47.5	19.5	
20 (a)	22	35.4	23.4	1.4	6.8 subcutaneously
(b)	29	68.7	45.3	16.3	
24 (a)	26	48.4	31.9	5.9	7.1 intravenously
(b)	32	58.6	38.6	6.6	
27 (a)	11	14.4	9.5	1.5	4.5 intravenously
(b)	20	70.8	46.6	20.6	
29 (a)	18	19.7	13.0	5.0	3.8 subcutaneously
(b)	24	80.6	53.0	29.0	
30 (a)	19	39.1	25.8	6.8	6.4 intravenously
(b)	25	78.8	52.0	27.0	

(a) = before administration of sodium bicarbonate; (b) = after administration of sodium bicarbonate.

COMPARISON OF THE HYDROGEN ION CONCENTRATION OF THE URINE AND THE PLASMA BICARBONATE

Effect of Food.—In Tables 5, 6 and 7 are shown the hydrogen-ion concentration of the urine (negative logarythm) and the plasma bicarbonate of apparently normal infants who were receiving different types of food. The hydrogen-ion concentration ranged from a maximum of 4.1 to a minimum of 6.9. The average hydrogen-ion concentration of the urine from all cases was 5.24. Henderson and Palmer found that

the urine of adults showed an average hydrogen-ion concentration of 6 The hydrogen-ion concentration of the urine of infants closely corresponds to the lower carbon dioxid tension of alveolar air and the lower plasma bicarbonate.

TABLE 5.—HYDROGEN-ION CONCENTRATION OF URINE AND PLASMA BICARBONATE OF INFANTS FED ON DILUTED COW'S MILK

Case No.	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Plasma at 0° and 760 Mm.	Case No.	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Plasma at 0° and 760 Mm.
1	5.7	54.3	9	4.8	57.4
2	6.2	58.6	10	6.8	72.0
3	5.8	58.7	11	5.7	60.3
4	5.7	50.9	12	4.8	56.1
5	5.4	63.0	13	5.5	59.3
6	6.0	60.0	14	6.9	79.8
7	6.3	67.0	15	5.2	63.7
8	4.9	58.0		Aver. 5.7	

TABLE 6.—HYDROGEN-ION CONCENTRATION OF URINE COMPARED WITH PLASMA BICARBONATE OF INFANTS FED ON PROTEIN MILK

Case No.	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Plasma at 0° and 760 Mm.	Case No.	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Plasma at 0° and 760 Mm.
1	4.2	54.6	9	5.3	62.1
2	4.8	58.1	10	4.2	60.0
3	5.6	63.2	11	4.7	54.3
4	5.8	61.0	12	4.8	55.8
5	6.0	71.0	13	5.9	61.0
6	4.6	60.0	14	6.2	76.1
7	4.3	58.0	15	4.7	59.8
8	5.1	66.0		Aver. 5.08	

Marriott suggests that the lower alveolar carbon dioxid in infants is due probably to more active metabolism, leading to the greater production of acids. Tables 5, 6 and 7 show that the hydrogen-ion concentration of the urine bears a definite relationship to the type of

TABLE 7.—HYDROGEN-ION CONCENTRATION OF URINE COMPARED WITH PLASMA BICARBONATE OF INFANTS FED ON DRIED MILK *

Case No.	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Blood Plasma at 0° and 760 Mm.	Case No.	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Blood Plasma at 0° and 760 Mm.
1	4.1	53.6	9	4.7	54.0
2	4.6	55.0	10	4.7	57.0
3	4.7	56.7	11	5.9	69.4
4	5.0	55.3	12	4.6	58.1
5	5.0	58.6	13	4.8	56.2
6	4.8	59.0	14	5.4	66.4
7	5.3	66.0	15	5.7	62.0
8	5.0	63.0		Aver. 4.95	

Average total (Tables 5, 6 and 7), 5.24

* The mixtures fed represented approximately 1.5 to 2 per cent. of fat, 4 to 5 per cent. of sugar and 3 to 5 per cent. of protein.

TABLE 8.—INFLUENCE OF FOOD ON THE HYDROGEN-ION CONCENTRATION OF THE URINE

Food	Hydrogen-Ion Concentration of Urine	Plasma Bicarbonate; C.c. of CO_2 Bound by 100 C.c. of Blood Plasma at 0° and 760 Mm.
Baby W.—		
Protein milk	4.8	57.6
Protein milk and potato gruel	6.3	63.7
Dried milk	4.3	56.7
Dried milk and potato gruel	6.0	59.3
Baby J.—		
Milk and water mixture	5.4	58.6
Milk and water mixture and potato gruel	6.3	61.4
Dried milk	4.6	58.4

food. The urine was more acid in infants receiving food richer in protein. The tables of Gettler show that the ash of milk is very weak in bases and could therefore neutralize but little acid.[8]

The influence of food on the hydrogen-ion concentration of the urine is shown by the work of Blatherwick,[9] and this influence is what

8. Gettler, A. O.: Dissertation, Columbia University, 1912.
9. Blatherwick, N. R.: Arch. Int. Med. **14**:409, 1914.

might be expected from the base contents of the food. In a number of our cases, the direct influence of food was shown by dietetic experiment. The results from two infants are shown in Table 8. In both instances, the addition of potato, which has a markedly alkaline ash, caused a reduction in the acidity of the urine. In both cases a similar, though less marked, influence on the alkaline reserve was observed.

Cases of Acidosis.—The results from fourteen cases of acidosis are shown in Table 9. The hydrogen-ion concentration of the urine is uniformly high, but the individual figures are no higher than some observed in infants without acidosis. With the correction of acidosis the hydrogen-ion concentration is lowered, as would be expected.

TABLE 9.—COMPARISON OF HYDROGEN-ION CONCENTRATION OF URINE WITH PLASMA BICARBONATE IN CASES OF ACIDOSIS

Case No.	Hydrogen-Ion Concentration of the Urine	Plasma Bicarbonate; Volume per Cent. of CO_2 Bound by 100 C.c. of Plasma at 0° and 760 Mm.	Case No.	Hydrogen-Ion Concentration of the Urine	Plasma Bicarbonate; Volume per Cent. of CO_2 Bound by 100 C.c. of Plasma at 0° and 760 Mm.
1	4.6	36.3	8	4.1	37.0
	5.2	56.1*		4.8	60.0*
2	4.8	41.3	9	5.1	29.0
	5.1	60.0*		5.8	62.0*
3	4.3	30.0	10	4.2	33.8
	6.4	78.7*		5.1	58.6*
4	5.0	39.3	11	4.7	39.0
	7.0	94.0*		5.7	60.0*
5	4.1	32.8	12	4.2	28.7
	6.7	86.0*		5.2	58.8*
6	4.8	29.8	13	4.5	31.6
	5.4	54.3*		6.3	79.0*
7	5.0	40.0	14	4.7	39.3
	6.5	87.3*		5.1	54.8*

* After administration of sodium bicarbonate.

The results shown in Table 9 demonstrate the disadvantage of gaging the administration of sodium bicarbonate by the reaction of the urine The use of such an indicator as litmus, which turns blue at a hydrogen-ion concentration of about 7, would necessitate raising the plasma bicarbonate much above normal. This has been shown by Palmer and Van Slyke.[10] Owing to this disadvantage, Marriott[11] sug-

10. Palmer, W. W., and Van Slyke, D. D.: J. Biol. Chem. **32**:499, 1917.
11. Personal communication.

gests the use of cresol purple (dibrom-cresol-sulphone-phthalein) which changes color at about 5.3. This is much more satisfactory for this purpose and obviates increasing the plasma bicarbonate much above normal. Even this indicator, however, is not entirely satisfactory, for the urine may be too acid to change cresol purple despite the presence of a normal alkaline reserve. In Cases 1, 2, 8, 10, 12 and 14 (Table 9) the plasma bicarbonate was practically normal, and the urine was too acid definitely to change cresol purple. The same criticism, however, applies to estimation of the hydrogen-ion concentration of the urine.

On the other hand, the use of cresol purple is of definite negative value in excluding the presence or persistence of acidosis. If the urine causes the development of a magenta or purple color, acidosis can definitely be excluded.

The disadvantage in using an indicator or to show when sufficient bicarbonate has been given is to a great degree hypothetical. Their use in determining the hydrogen-ion concentration of the urine could lead to no more than a slight increase of the plasma bicarbonate. While on general principles it would seem desirable to bring the plasma bicarbonate to normal and no more, yet it has not been demonstrated that a moderate increase in the plasma bicarbonate is necessarily harmful. In this connection Palmer cites a case observed by Tileston in which too much sodium bicarbonate was given and tetany resulted. In several of our cases the administration of large amounts of sodium bicarbonate was followed by tetany, or edema, or both. Whether these conditions were a direct result of increasing the plasma bicarbonate above normal is difficult to determine. We have observed a number of cases in which sufficient bicarbonate was given to raise the plasma bicarbonate above normal but without the appearance of edema or tetany.

Despite the fact that there is no convincing evidence that an excess of plasma bicarbonate is necessarily harmful, it would seem more nearly ideal to avoid raising the alkaline reserve much above normal. This can be done best by using the plasma bicarbonate as a therapeutic guide. If the determination of the plasma bicarbonate is not possible, the use of such an indicator as cresol purple is desirable. Even if with its use the alkaline reserve is raised somewhat above normal, this condition is of infinitely less danger than that of acidosis.

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DISCUSSION

DR. MARRIOTT: I am very much interested in this work. Our experience has been the same as that of Dr. Schloss, particularly in regard to the failure of the alveolar carbon dioxid to indicate the presence of acidosis after sodium bicarbonate has been given.

In regard to the reaction of the urine as a guide to the amount of bicarbonate to be given, if we take the alkaline reaction to litmus we may make a mistake and give too much bicarbonate. The urine reacts to litmus when the alkalinity is about 7, while if the urine is brought to a normal reaction it is, in infants, about 5.5. Hence, with the litmus one would get an acid reaction, but it would be a normal acidity. The best way is not to use litmus, but to use an indicator which will change somewhere near the normal acidity of the urine. Cresol purple changes at about 6, which is just about the reaction of the urine when the bicarbonate of the blood has reached its normal concentration.

INTRATHECAL INJECTION OF HORSE SERUM IN THE TREATMENT OF CHOREA

A PRELIMINARY STUDY OF SEVEN TREATED CASES

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The clinical picture of chorea has never been more succinctly drawn than it was by Sydenham, who first described it as a clinical entity. Little was added to our conception of the disease until the middle of the nineteenth century, when the French clinicians made it a matter of particular study, and later German clinicians and Americans, especially Weir Mitchell and Osler, did much to separate the malady from similar nervous diseases. Later Osler was especially active in attempting to reach the etiology of the disease, together with Stephen MacKenzie he was instrumental in emphasizing the relation of chorea to manifestations of the group of symptoms then known as rheumatism, although as early as 1866 Germain See had insisted on this relationship. MacKenzie was able to relate less than 30 per cent. of his cases of chorea to rheumatism, and later observers, notably Morley Fletcher and Hughes, record similar findings.

With the increasing influence of bacteriology came a suspicion on the part of the medical profession that chorea was an infectious disease. The striking and well authenticated findings of Poynton and Paine, who demonstrated a diplococcus which they claim is etiologic in cases of rheumatic arthritis and endocarditis, and the earlier and somewhat similar findings of Wassermann and Westphal led to a further investigation of the relationship between these two diseases, and the former observers reported the presence of their diplococcus rheumaticus in certain tissues of patients dead of chorea, especially in the spinal fluid, while some of their pupils were able in experimental animals to develop nervous symptoms analogous to the symptoms of chorea as it exists in the human; and from the brains of such animals the *Diplococcus rheumaticus* was recovered. In spite of this work, however, the medical profession for the most part remained unconvinced that chorea is of proved infectious origin, and it must be said that the chemical findings in the spinal fluid and the cell counts, both

in this fluid and in the blood, are not what experience would lead one to expect in a disease of bacterial origin.

Pathologists have nevertheless continued their search for an infective factor in this disease, but apparently with little satisfaction. The results of bacteriologic examinations have been most contradictory, whether it has been throat secretions, blood or spinal fluid that has been explored. Negative results have rewarded La Fétra, Bartley, Koplik, Morse, Collins and Passini, although streptococci have grown for Richards, Morse and La Fétra in a small proportion of their cases; staphylococci for Donath, diplococci for Apert, Richter and Collins. All these positive results have been reported in cases uncomplicated by symptoms of rheumatism or endocarditis. In instances in which the disease has accompanied rheumatism, tonsillitis or endocarditis, Richards, Poynton and Camesa have reported positive findings of streptococcus or diplo-streptococcus, while Poynton and Paine have recovered the diplo-streptococcus from rheumatic patients and Rothstein a hemolytic streptococcus from tonsils of choreic patients. Spinal fluids in this disease have been cultured by but few, among these Collins, Passini and Morse and Floyd, all of these with negative results. Animal experimentation has been attempted by Poynton and Paine, Pianese, Donath and Dick and Rothstein. None of these observers have reported results that can be considered conclusive. The latest and most suggestive study is that of Quigley.

Quigley reports that of 21 cases studied 10 yielded positive cultures from both the blood and spinal fluid, and 14 in either one or the other. Six bacterial strains isolated from the tonsil, 8 from the spinal fluid and 9 from the blood, were identical in their morphologic and cultural characteristics. It therefore seems to him that bacteria are of importance in the etiology of chorea, and he believes that the coccus described by him is the organism most frequently present in this disease. He finds this opinion supported, not only by his own work, but after a critical review of the work of others. He thinks that the grouping of the organism, its slow, scant, pin-point growth on blood agar, the slight turbidity and the fine granular sediment which it produces in broth, relate it to the streptococci. In the predominance of pairs, with few short chains, and a few irregular groups, when grown in broth, it resembles the streptococci also, and especially the streptococci or diplococci frequently found in rheumatic fever and in endocarditis. It should be noted that the strains studied do not as a rule cause hemolysis

on blood agar plates. No definite grouping can be made on the basis of the fermentative reactions as observed.

So far experiments on animals with this coccus, which is being studied further, have been inconclusive.

Although one may not expect the dictum of Faber that "it is generally recognized that chorea is a bacterial disease due to the *Streptococcus viridans* group" it is difficult to escape the conviction that in many cases, at least, of chorea we are dealing with a general infection with special localization of bacteria or bacterial products in the nervous system. Besides the scanty evidence already quoted, there are a few reports to be found in the literature in which diplococci or streptococci were revealed at necropsy, or in which emboli were found deep in the cortex. However, when one considers that chorea is rarely a fatal disease, necropsy findings on individuals who have died with chorea can not be accepted as conclusively demonstrating the presence of such infective organisms in most cases of chorea. Nevertheless, there is sufficient evidence to justify the physician in an attempt to treat the malady on an assumption of its infectious origin and when the unsatisfactory results that follow the usual methods of treatment are considered, such an attempt seems doubly worth while.

It is the merit of Goodman that he has attempted to apply to the treatment of this disease modern principles of immunity and to introduce immune bodies produced in the patient's blood into the dural space in order that invading organisms shall the more readily be destroyed. His method, briefly, is to remove 45 or 50 c.c. of blood from a vein of the patient, separate the serum and inject this serum into the spinal canal after the withdrawal of a somewhat larger amount of spinal fluid. This injection may be repeated from one to four times. According to his report the results that followed this treatment were amazing. To quote Goodman: "With the autoserum treatment the result is manifest within two or three days—usually one injection is sufficient." Goodman made no differentiation between his mild and severe cases and he classed his results on the basis of the cessation of twitching. In his terminology a "cure" is an absolute disappearance of twitching within a week; "marked improvement," a cessation of twitching within two weeks; "slight improvement" when the movements disappear by the end of the third week; and if after four weeks there is still involuntary movement, he classes the case as "unimproved." Of course, in estimating the cure of chorea much else should be noted

besides the twitching. The emotional state of the patient, his fatigueability and the reinstatement of his cerebral inhibition over voluntary movement are of equal if not of greater importance in gaging progress toward returning health.

I was attracted to the Goodman treatment through an opportunity given me by Dr. H. K. Faber to watch the course of events after treatment given one of the patients at the Stanford University Hospital. Faber treated three cases by this method and reported them. He was very much impressed with the results, as in each instance almost complete cessation of the symptoms followed within a week after a single injection of autogenous serum.

In considering the results attained by Goodman's treatment it occurred to me that perhaps the whole effect was attained because the injection of the autogenous serum had set up a sterile meningitis and so had increased the permeability of the choroid to such a degree that antibodies were able to pass from the blood stream into the lymph spaces of the central nervous system. It is well recognized, due to the published work of Mott, Leri, Orofici, Flexner and Mehrtens, supported by other unpublished work, that the injection of foreign protein does break down the defensive power of the choroid and allow substances which ordinarily do not pass to move from the blood into the central nervous system. Goodman, himself, insists that it is necessary to withhold all medication for some days before instituting the treatment. One of his patients who had been receiving chloral and codein, went into deep coma which lasted for thirty-six hours after the first injection. This circumstance was attributed to "some chemical action in the blood plasma which causes a very potent action of drugs when injected into the spinal canal." There is reason to believe, however, that this result was due to an increased choroidal permeability produced by the proteins injected into the spinal canal. This possibility is most clearly set forth in the researches of Flexner and Amoss, who, working on poliomyelitis, first showed that antibodies might be drawn from the blood into the spinal fluid following the introduction of irritants into the subarachnoid space. They were able to grade these irritants in order of their potency from horse serum, which was the most powerful, down to simple drainage of the cerebrospinal canal, which was least irritating. Ranging between these two extremes were the power of heterologous serums, homologous serums, and hypotonic and hypertonic salt solution. Mehrtens has demonstrated that

homologous serum injected into the subarachnoid space produces an irritation manifested by a cell count sometimes as high as 1,800 cells to the cubic millimeter, and that a drainage of 30 to 50 c.c. of spinal fluid may be followed by the secretion of a fluid containing as high as 10 to 80 cells. Mehrtens was able to bring sodium iodid out of the blood into the spinal fluid by injecting the drug intravenously six hours after an injection of 10 c.c. of normal horse serum had been made into the subarachnoid space.

These facts, taken together with the knowledge that horse serum injected in the form of immune antimeningococcus serum is innocuous to children, seemed to warrant the use of horse serum by intrathecal injections in the treatment of some cases of chorea admitted to the Hospital for Children in San Francisco. Seven patients have received such injections, and another case has been treated by the method Mehrtens of Stanford University is using in the treatment of cerebrospinal syphilis, namely, the injection of salvarsan six to twelve hours after the preliminary intrathecal injection of horse serum. Of the cases so treated, one was of the maniacal type, quite the most severe case conceivable; one was of severe hemichorea with pseudoparesis; two very severe; one was of moderate severity, and two were mild, although one of these had been very persistent; three of the attacks were recurrences. The first four patients treated received an initial injection of 20 c.c. of normal inactivated horse serum half an hour after a half c.c. of the same serum had been given subcutaneously in order to test whether or not the patient was hypersensitive to the serum. Five of the patients received a second injection on the fourth, fifth and sixth day following the initial treatment. One little girl reacted so violently to the first injection that repetition was deemed inadvisable, and through a mistake another was allowed to go beyond the period of anaphylactic sensitization, so in this case also it was thought best to forego the second injection. Two patients received injections of 10 c.c. only.

Accepting the premise that the mechanism behind Goodman's results was a protein reaction which let down the choroid plexus barrier that prevents circulating antibodies from entering the spinal fluid, it is obviously of advantage to use normal horse serum instead of autogenous, because the former is more convenient to obtain and to administer and at the same time it is a more potent irritant to the meningeal structures than is homologous serum.

Two sets of unpleasant reactions have followed the use of the horse serum within the spinal canal, an immediate reaction which was evidenced by prostration, by headache, and sometimes by severe vomiting. These phenomena also appear after the injection of homologous serum. They are familiar to those therapists who use the Swift-Ellis technic in the treatment of syphilis. Goodman attributes these untoward symptoms to pressure, but, as in his cases and in this series, uniformly an amount of serum was injected less than that of the spinal fluid withdrawn, pressure cannot be incriminated. The knowledge Flexner and Amoss gained for us about the irritating quality of serum injections is confined by the cell counts made by Mehrtens ten hours after the injection of horse serum, when that observer showed a pleocytosis of from 10,000 to 80,000 cells to the cubic millimeter. Further confirmation was had by our own cell counts and the results of chemical reactions in fluids withdrawn from eight to fourteen hours after the injections. It is striking that the only child who showed no improvement after these injections was one whose spinal meninges did not react to the serum by an increased cell count. The second unpleasant reaction appeared after a week and was evidenced by the usual symptom of serum disease; the distressing urticaria was readily counteracted by injections of epinephrin given subcutaneously.

The number of cases treated is too few from which to draw valid conclusions; however, if we use Goodman's criteria, the injections of horse serum have been instrumental in gaining striking and rapid improvement in most cases, but no improvement has been such that a cure can be claimed on the basis of "absolute cessation of all twitching within a week." In fact, only in the mild cases was twitching entirely absent after two weeks, and all three of these patients had been affected for at least three weeks before treatment was inaugurated. One patient, a girl (a mental defective with a neurotic heredity), showed absolutely no reaction to the injections of serum. The most striking results followed the use of the horse serum in the maniacal and very severe cases. Before the serum was used, two of these patients could be kept in bed only by the use of restraining packs, but within forty-eight hours after the first injections both were able to carry a cup to their mouths and to drink without any assistance from the nurse. The restraining pack was no longer necessary and there was a steady diminution in all the excessive movements, while the mental conditions, especially the emotional overflow, were markedly improved. By the

end of the third week it was with difficulty that choreic movements could be brought out, but even then they could be elicited by allowing excessive excitement or persistent mental strain to affect the patient.

Undoubtedly the use of horse serum is of great value in controlling these very severe cases. My experience with the Goodman treatment is not sufficient to allow me to express a personal opinion; but, accepting his findings, it seems that the autogenous serum is a therapeutic agent preferable to horse serum in chorea. One would not choose to use horse serum in the treatment of any moderately severe or mild case, but in any attack of great severity the method will certainly bring rapid benefit to the patient.

The last child treated received 5 c.c. of horse serum in the spinal canal, and this was followed in twelve hours by half the normal adult dose of arsphenamin by the vein. The case was an exceedingly severe one, especially on the emotional side, and while there seemed to be marked amelioration, immediately after the treatment, which persisted for some weeks, there has since been retrogression. It is, of course, impossible to draw conclusions from a single case treated so recently, but on the whole the result obtained does not encourage the hope that this is any advance on other methods of treatment.

We have been struck by the fact that injections of smaller amounts of the serum are as effective as are the larger. In future, in applying this technic, not more than 5 or 10 c.c. of serum will be used at a single injection. The value of repeated injections also seems to be demonstrated. The headache and depression that followed the first injection are rarely manifest after subsequent treatments.

The fact that the withdrawal of blood from a donor and the preparation of a sterile homologous serum present great technical difficulties, while sterile normal horse serum is easily obtainable and the technic of its use is simple, led to the hope that the use of the latter agent might give the profession a valuable means of dealing with a distressing malady. A measure that could be applied without harm to patients outside the protecting walls of a hospital. The cases here reported are too few to say that the hope is realized, but there can be no doubt that in the most severe cases the injections of normal horse serum bring about rapid diminution of the more explosive symptoms. Parents who naturally are uneasy during the stage of first reaction following a treatment are uniformly delighted at the promptness with which their children gain control of movement and speech and lose their emotional excitability.

Of course, this method is no panacea for chorea. The fact that these children have a congenital inferiority of the nervous system means that rest and overfeeding will always be essential parts of the treatment. Head's dictum that the cure for chorea is six weeks in bed, four eggs and two quarts of milk a day, must still be remembered; nor must it be forgotten that any focus of infection, especially if it be in the tonsil, must be removed. Warm baths and massage ought never be omitted from the regimen. Care must also be taken to heed the psychologic reaction inevitable between choreic patients and their environment. Therefore, it is wise to keep the family and the usual attendants away from close contact with such children during the course of treatment. Under such management mild cases of chorea will rapidly achieve normality. However, when the patient is affected with severer forms the results of such measures are delayed for weeks or months. In these circumstances the little patients become a great distress to themselves and to all about them, and it is to such that the intrathecal injections of horse serum offer a therapeutic aid which is harmless and which at the same time will bring prompt relief to the more dominant symptoms, and probably, though not certainly, will hasten the final recovery.

While there is no certainty that chorea is an infectious disease, treatment based on that idea can be warranted only by clinical results. Never can the psychic disturbance of chorea be overlooked, and it may well be that the results which follow the use of serums are evidence of a successful, if unwitting, application of suggestive therapy. At any rate we have every right to hope that further investigation will establish the serums as valuable measures in the treatment of selected cases of chorea.

SUMMARY OF CASES

CASE 1.—O. W., boy, aged 11 years; second attack; duration two weeks from commencement of treatment; very severe maniacal delusions and great excitability; had to be restrained in bed; characteristic twitchings; unable to speak intelligibly; heart normal; tonsils showed chronic infection. Injection of 20 c.c. of serum given, followed by vomiting, prostration, slight pyrexia, and immediate exaggeration of all symptoms; reaction disappeared in thirty-six hours. Second injection of 20 c.c. was given on the fifth day following. All twitching had disappeared in forty-eight hours. The excitability with emotional overflow persisted for about two weeks. Besides the serum treatment, the patient had continuous hot packs, a high calory diet, and during the third week in the hospital, tonsillectomy. There was a relapse during the two weeks following the removal of the tonsils. During the next two weeks all symptoms disappeared. The patient was dismissed and has remained free for two months.

CASE 2.—M. P., girl, aged 8 years. The patient, who had a neurotic family history and was a masturbator and a mental defective, had had a persistent chorea with short periods of remission for the previous three years, although the manifestations were mild. Her symptoms were twitching, emotional excitability and overflow, a clumsy gait and blurred speech. Her heart was normal; throat was healthy. She was given 20 c.c. of serum on two occasions, four days apart. A slight reaction, with vomiting, headache, and low fever, persisted for forty-eight hours after the first injection. She had slight diminution of symptoms after the second day, but final result showed her to be no better than before treatment. This is the only case in which some definite influence over the course of the disease was not manifest.

CASE 3.—J. H., girl, aged 11 years; second attack; was very severe. There were many other cases of chorea recorded in the family history. She had been ill for eight weeks. Her symptoms were twitching, persistent headache, speech disturbance, excitability, emotional overflow. She had chronic inflamed tonsils and had suffered from recurrent tonsillitis. She received 20 c.c. of serum without a second injection and she reacted to the serum with headaches, stiff neck, stiff legs, vomiting and later a severe urticaria, all of which symptoms disappeared within forty-eight hours. Improvement began at this time and continued uninterruptedly. She was dismissed after three weeks perfectly well. Besides the serum she received a high calory diet and a short course of hot packs.

CASE 4.—L. S., boy, aged 13 years; severe attack, hemichorea type, which was the second attack. He had suffered from a very severe seizure two years before. The duration of the present attack was three weeks. Symptoms were twitching, right pseudoparesis, emotional disturbance, speech disability. He was hardly able to walk. The heart showed a slight systolic blow; no endocarditis. He had chronic recurrent tonsillitis. Received 10 c.c. of serum and no second injection. He reacted with headache, slight urticaria and slight purpura, all of which disappeared in thirty-six hours. He showed a steady improvement and had a slight relapse lasting for about three days after the removal of his tonsils during the second week of treatment. He was dismissed in a month, having showed no further symptoms after the third week. There had been no return of symptoms up to the fourth month.

CASE 5.—D. J., girl, aged 13 years. This was a very severe attack, with frequent exacerbations. The patient was so uncontrolled that she had to be restrained in bed. This was the first actual attack, although she had been "very nervous" for the past five months. The actual attack was of three weeks' duration. The symptoms were twitching, loss of motive power, loss of intelligible speech, emotional overflow and a mild adiadokokinesis. Her heart was normal. Her tonsils were slightly injected. She was given an initial dose of 20 c.c. serum and five days later another 20 c.c. She had a violent reaction to the first injection with extreme vomiting and some pyrexia, which persisted for thirty-six hours. A week later there was marked urticaria for one day which was well controlled by epinephrin subcutaneously. The alleviation in this case was striking. The child, who was utterly helpless before treatment, was able within forty-eight hours to feed herself and to drink water from a cup unaided. She went on to complete recovery and was dismissed without symptoms at the end of her third week in the hospital. She was given high calory diet, hot packs, as well as serum treatment. A cure could not be claimed, because she was still highly emotional, and she had a short relapse two months after leaving the hospital.

CASE 6.—V. B., girl, aged 10 years. First attack, but "always nervous." The duration of the attack was three weeks. It was a mild case, evidenced by twitching, emotional overflow and slight speech disturbance. Her heart was normal. She had chronic recurrent tonsillitis. The first injection was 7 c.c. of a serum and the second 10 c.c. The reaction was slight and she complained of a mild headache and backache. She had low fever and was restless. The symptoms of chorea were exaggerated for the first two days; then there was steady improvement. Her tonsils were removed two days before the serum was injected. She was given high calory diet. Her progress was uninterrupted and the symptoms had disappeared entirely in three weeks.

CASE 7.—R. M., boy, aged 14 years. Family history not neurotic. This was the fourth attack. The boy had suffered from an attack of rheumatism in his eighth year, and this was followed by chronic endocarditis, and a pseudoparetic chorea, lasting four months. There was a third attack following this, which lasted for six weeks. There was a second attack which lasted six months. His tonsils had been removed between the second and the third attacks. The present seizure had lasted two weeks. He had lost power to use his right hand, he dragged his right leg, his speech was greatly disturbed, he had marked choreic movements and emotional overflow. His heart showed the evidence of old endocarditis; his throat was healthy, tonsils out. He received an initial injection of 20 c.c. of serum and a second dose four days later of another 20 c.c. After the first injection he reacted with headache, vomiting, anorexia and the choreic symptoms were worse. Within forty-eight hours this reaction abated and from that time he made a rapid improvement. Packs and high calory diet were also prescribed. The symptoms were entirely gone in two weeks and he had no return after six months.

DISCUSSION

DR. SCHLOSS: The results with the autoserum treatment on Dr. La Fétra's service at Bellevue Hospital are interesting. Twelve children were treated, and while some of them improved after the second or third injection of serum, the results as a whole were no better than those obtained by the usual methods. There was only one patient who improved to any great degree after a single injection of serum.

There was one case of special interest. A girl of 13 years who was on the medical wards had the worst attack of chorea I have ever seen. She had very violent movements of all voluntary muscles. Dr. Meara kindly consented to have her transferred to the children's ward for the autoserum treatment. When I saw her the next day she was lying quietly in bed, and was almost free from muscular twitching. Only on close inspection could slight choreic movements of the fingers be detected.

I asked the resident physician when she had received the serum, and he stated that no serum had been given at all.

DR. HERRMAN: Was the spinal fluid removed before the serum was employed? If the spinal fluid was withdrawn, was there an improvement afterwards? Possibly the improvement might have resulted from the relief of pressure. At the Lebanon Hospital we have sometimes seen a favorable effect follow the simple withdrawal of spinal fluid.

DR. LA FÉTRA: In regard to the cases at Bellevue, it is not altogether a simple matter to draw off the blood and keep it sterile and then inactivate it. For some reason we did not get brilliant results from the treatment Dr.

Goodman recommends, and we did not feel that we were justified in continuing to use it.

I had two cases of chorea as nearly alike as two cases could be. One was given serum and the other was not; if there was any difference between them, the one that did not receive the serum recovered more quickly. You have already been told of the striking case in Dr. Meara's service, an almost miraculous improvement taking place spontaneously. I should like to see Dr. Porter's method employed more extensively; for I think there are many advantages in using other than autogenous serum.

DR. PORTER: *Apropos* of what has been said, I would like to quote from my paper: "Never can the psychical disturbances of chorea be overlooked, and it may well be that the results which follow the use of sera are evidence of a successful, if unwitting, application of suggestive therapy."

I formerly believed that chorea and rheumatism were an entity and that if we took out diseased tonsils we removed the cause of chorea. In connection with this belief I had an interesting experience. A choreic patient was brought to me from Southern California, a very intelligent, alert little girl of about 12 years. While she was in the room I explained my belief that if the tonsils were removed the child would get well of the chorea. The child went home and the tonsils were removed, and the mother wrote me later that after the child came out of the anesthetic she had not a single recurrence of the choreic movements; so for a time I hoped that it was true that if we anesthetized the victims of chorea we might cure their disease, but experience soon showed me the error of this idea. However, I am very much interested in getting something that will relieve the distress of these children who are truly most unhappy. This is only a preliminary report and the conclusions tentative, but I feel that these children who had severe seizures and had to be restrained were definitely quieted and calmed as a result of the injection, but that nothing like a cure can be claimed. I would like to have some of you follow up this treatment and express an opinion on its value. The reactions are severe. The worst thing that happens is that the child may vomit and become depressed, and more so when we use 20 c.c. than when we use 10 c.c. I think it is better to withdraw a good deal more spinal fluid than the amount of serum to be injected. All these cases showed high intraspinal pressure. There is nothing in the findings of the blood or spinal fluid to lead one to believe that in chorea there is an infection, for the cell count and globulin content are normal.

THE IMPORTANCE OF CHILD WELFARE CAMPAIGNS DURING THE PRESENT PERIOD

WILLIAM PALMER LUCAS, M.D.
SAN FRANCISCO

I wish to emphasize the importance of the campaign which the Children's Bureau is carrying on in France. As a member of the American Pediatric Society and as a representative of the American Red Cross, I wish to speak to you for the purpose of emphasizing one or two things which have been more or less widely spread about and which ought to be corrected. The French people and the French government have a well organized child welfare work. They were the first to get the idea of doing child welfare work and the first to put it into effect. Infant welfare work was started in France by Budin, and it has been taken up all over France; even the small towns have infant welfare stations.

The situation is this: Every physician in France who is under 55 years of age has been mobilized, and many of those over 55 years of age are doing part time military work. Men like Marfan have mobilized themselves for military work and are doing part time service. Practically every doctor is in military service. A great many of the children's institutions have been closed and their work has stopped. In relieving this situation the Red Cross has been most active. The Children's Bureau of the Red Cross started with eleven members. Dr. Sedgwick started the work at Toul, practically under shell fire and aerial bombardment. He was practically working in the war zone, being no more than 12 or 15 kilometers back of the war line. It became necessary to take all the children back from the war zone to concentration camps or colonies. In this way large children's colonies were established, some of them having 500 or 600 children. Dr. Sedgwick started with 70 beds, and that institution now has 200 beds, fifty being for maternity cases. In two or three places we have maternity hospitals in connection with children's hospitals.

The work outside of the big colonies is practically the kind of work we do here in our big cities. We have dispensaries, and also traveling dispensaries, which cover a radius of from 10 to 20 kilometers. These are motor dispensaries and hold clinics at the various

towns and villages at stated times, two or three times a week. In this way we are now able to work in a fairly efficient manner. About 50 per cent. of our physicians are women, and we have about 150 nurses and nurses' aids. The Bureau has a personnel of about 400, though it varies somewhat from time to time. During the last offensive we had an active part, not only in assisting the refugees, but also in helping to care for the wounded at the front. Our doctors and nurses created a number of emergency stations and small temporary first aid units. Dr. Baldwin and Dr. Mixsell did most of this work themselves. Most of our work, however, is not of that type, but just the ordinary work that is done in civil life that does the most good — the visiting dispensary and the active hospital work — and this is the part upon which I wish to dwell.

We are carrying on this work in connection with the French government and the National Health Association. We have worked out a simple child welfare plan for all France. In this work there are practically only three principles involved. First, we are reestablishing as many consultations as possible. In Paris Dr. Knox and Dr. Manning have twelve or fifteen dispensaries. There are nurses doing follow-up work, and full-time work is being done, and they cover a great deal of ground. Dr. Grulee is in Lyons and had charge of a 200-bed hospital and a general hospital. The general hospital has been taken over for military work. Many of the general hospitals have had to be taken over for military work and our hospitals have to take care of the women and children. In Marseilles and Bordeaux, and in the smaller towns of Chartres and Etienne, there are doctors and nurses carrying on the same type of work. Besides starting up this kind of work, which had died down during the war, owing to the fact that funds were directed to war needs, we are carrying on a second measure, which is the education and preparation of health visitors. France, on account of having expected war for the last forty years, has not been able to build up a health follow-up work as we have done in this country. We have established follow-up work in Paris, Bordeaux, Marseilles and Lyons. It is interesting that under these emergency conditions we can take the best type of intelligent girl or woman and in four months we can make of her a very efficient worker. The development of this work parallels very closely what I have found in the cities here. Many women and girls have started in this kind of work.

The third type of work was debatable as to whether it would be effective. This is the educational work — an educational campaign and exhibits. We had a small automobile exhibit and started a campaign in Chartres, and in sections where there are dispensaries we take the small exhibit and distribute literature and hold conferences on child welfare, and on tuberculosis, because we are working in cooperation with the Rockefeller Foundation, which is carrying out on a large scale a campaign against tuberculosis. The first large exhibit took place from the tenth to the thirtieth of April in Lyons. For this exhibit we had a large automobile pavilion where we demonstrated practically every phase of child welfare work from the prenatal work, through the period of infancy, the pre-school age and the school age. All the phases of playground and kindergarten work were included. The attendance and the reaction that this campaign has brought out has convinced us as well as those who saw it. For instance, President Vincent of the Rockefeller Foundation, felt that from the standpoint of effectiveness and of creating a good *morale* it has done more than anything else that we have been doing. The word *morale* is very hard to define and yet the thing itself is very definite and permeates the atmosphere of the whole community. It is something which we can feel. If the American Red Cross had done nothing but create a good *morale,* the work it has done would be worth while. The progress of the Red Cross in this direction since our arrival is most remarkable. We have tried to get into touch with the soldiers; we have come into direct contact with their families, and we are doing what we can to assist French organizations.

The educational work has had a very wide reaction from the standpoint of getting people who have been feeling keenly the effects of the war to think of themselves and of their families; you have no idea here how important that is. The French thought the war would be more or less a short affair, and they left out of account child welfare work, and it has been interesting to find, when they saw the necessity for it, how rapidly that work developed. I have had the assurance of the French government that it would develop a modern children's department in the national Public Health Service, and it is with that idea that Dr. De Lille was assigned to come to this country to study our methods and the way the infant welfare work is carried out. The thing that has impressed me more and more is the importance of this work during war. It is encouraging that we have been following the

type of work that is done over here and the type of work that can be done on a large scale, the type of work done in England by the Local Government Board, which shows that a definite method of attacking some problem brings big results. Another thing that has impressed me greatly is the importance of the medical man taking up this problem in a serious way and not allowing it to drift into the hands of non-medical people. After the experience we had with the tuberculosis situation, which the medical men did not take up as actively as they do at the present time, and which fell into the hands of nonmedical people, we should have learned our lesson and should recognize the importance of the medical men getting hold of the child welfare problem and starting the child welfare work in the right way. We have in America a great opportunity to take up this work and promote it in a scientific way. We should come into the work of the Women's Council of the Council of National Defense whether we like their program or not. They will continue to develop it further and further, and unless you make your influence felt in their work they may go in the wrong direction. One remark that I heard is perfectly characteristic of the situation. "We ought to have a medical man in our work, but when we ask them to assist us we get nothing done." It undoubtedly involves a great sacrifice to ask a medical man to devote his time to this work, but I feel that there are a certain number of physicians who should do this type of work.

From the standpoint of infant mortality the French work is very interesting. Among the warring countries we cannot get statistics, except in England. The situation in France is that the infant mortality did rise very high during the second year of the war. During the last year it has come down very considerably. The reports of the last five years in Paris show an infant death rate of 126 per thousand births, which is higher than normal, but the important point is the question of the reduced birth rate, which emphasizes the importance of all child welfare work. While our normal birth rate is about 11 per cent. over the normal death rate, France has had a birth rate only 1 per cent. over the death rate, and at present the birth rate is 40 or 50 per cent. below the normal death rate which makes anything in the way of infant welfare very important. When we get one, two, three, or five million men going over, that is going to make a tremendous fall in the birth rate here, and will make us recognize more than we do today the importance of child welfare work here.

I have here a number of photographs showing the type of work we are doing in France. The French people are not starving. Your work in the voluntary conservation of food has had a very definite and marked effect over there. It is a matter of historical record throughout the past that when the people behind the fighting line are starving the war is over. As long as they have plenty of food in France and England you may know that we are not losing the war, and that your saving is having a very definite effect.

The point I wish to emphasize is that I feel very, very keenly that before this Society adjourns it ought to go on record that we will take an active part in backing up all child welfare work done in this country and abroad.

As I have said, with war in France and England and in this country, if we could work up a congress, it would have a good effect on the whole situation. There is nothing that would bring about a stronger reaction than getting the viewpoint of the several countries together, at the same time seeing what is being done. If it is possible, it would be most desirable to have such a meeting. There are a number of organizations in France who would send representatives, and if you will send representatives, the Children's Bureau is also ready to send such representatives, and the Local Government Board in England and the French National Association are ready to send representatives. The psychology of having such a thing start during the war should be considered. The psychologic effect of such a congress would be to focus interest on it and to accentuate the importance of child welfare work. Unless we get started now we are going to lose an opportunity, and this, I feel, would be a tremendous mistake.

THE MEDICAL SERVICE FOR THE RAPATRIÉS AT EVIAN

PAUL F. ARMAND-DE LILLE, M.D.
Medecin des hopitaux de Paris; Medecin Major de l'Armée Francaise, etc.

In the beginning of 1916 the Germans commenced to return to France a certain part of the population of the occupied territories, not with an humanitarian object, but in order to make place for their soldiers and divisions of the military services, as well as to improve the food situation.

They first deported them to Belgium for several weeks, at least, and often for several months, where they lived under extremely bad, even inhuman conditions as regards housing. You know they were supplied with food only by the former American Commission for Relief in Belgium, at present directed by the Spanish and Dutch. Then they were crowded in trains without light or heat, even in the depths of winter. Those trains transported them to the Swiss frontier, where the French government, aided by that of the Swiss, had organized a service to carry them the rest of their journey into France.

The *Service des Rapatriés* was first created at Annemasse, but later removed to Evian, where there existed in the shape of the Casino Municipal a location sufficiently large to permit of a complete organization.

Because of the hasty organization of the medical service, it was not sufficient. The *Ministers de l'Interieur* therefore decided in the month of August, 1917, to establish a complete medical service answering effectively to the necessities of prophylaxis and of general assistance, and submitted to me the problem.

This service, organized in the month of September, began to function normally from the month of October, 1917, and I have carried it on from that moment with only slight changes and perfection of details.

In this work I have the help of ten medical officers of the French Army and of the physicians of the American Red Cross.

DIVISIONS OF THE SERVICE

The organization of the medical service is essentially as follows:

1. A general prophylactic service against the diseases transmitted by animal parasites. This is accomplished by a complete installation of shower baths, with disinfection of clothing.

2. A service for the diagnosis and isolation of cases (particularly children) affected with contagious diseases.

3. Diagnosis and redistribution of patients. This is accomplished by individual examination at the casino in Evian.

4. Diagnosis and redistribution of the tuberculous.

5. The medical service includes also a Service of Hygiene for the lodging of the *rapatriés* in the hotels at Evian, and in the district which was organized with the aid of visiting nurses supplied by the French Red Cross, and at present also with the aid of the American Red Cross.

6. A Service of Investigation tending to determine the sanitary conditions existing in the invaded districts and operating by means of the interrogation of the *rapatriés* during their passage through the Casino.

Since the autumn, there have arrived regularly each day excepting Sunday, two convoys from 600 to 650 *repatriés.*

The Germans first rid themselves of those elements of the population which were the most troublesome to them from the standpoint of care; in other words, the sick, principally tuberculous, the old and the occupants of the hospitals and asylums for the insane.

At present they send especially women, children below the age of 16 years, and the aged people, because they hold, for the work which they are obliged to furnish like slaves, all the healthy men from 16 to 60, and, often enough, even the young women from 18 to 25 years who are taken from the arms of their parents to be sent to unknown districts.

The *rapatriés* convoys, whom the Swiss receive first with the most admirable charity, arrive at Evian accompanied by nurses of the Swiss Red Cross, in a condition of marked material and mental depression.

In general, their papers have been taken from them by the Germans, so that it is necessary to furnish them with new articles of citizenship. They have also been robbed of their money, their jewels, and every-

thing else valuable which they may have possessed, permitting them only to bring their clothes and those strictly personal articles, except those in metal or in leather.

Arrived at Evian, they first listen to the "Marseillaise," then receive a comforting meal and hear a little speech of welcome offered by an official representative. The French government, by means of its appointed officers, then furnishes them with the necessary papers to establish their civil state.

At the same time they find letters from their families and friends in France, and also the information on the persons who may be looking for them.

After having passed the different services which I will describe a little later, also that of an Intelligence Service, they are directed to hotels of the town for twenty-four or forty-eight hours.

A *Vestraire* Service, supplied with larger resources, allows the *rapatriés* to be given the necessary clothing. They are distributed to the various regions of France, either with their families, who welcome them, or in the cities or rural communities designated successively by the government to receive them. In the various regions containing *rapatriés,* a department of the A. R. C., that of Refugees and Relief, furnishes a welcome aid in the housing of this new population.

MEDICAL SERVICE

General Mode of Functioning of the Service

1. *Immediate Hospitalization.*—At the French frontier each train leaving Bouveret carries a physician, who, aided by two nurses, makes a preliminary selection of the acutely ill or incapacitated during the passage to Evian and furnishes them with a ticket giving a diagnostic summary. On arriving at Evian these patients, instead of following the convoy, are brought at once to the station infirmary where American Red Cross automobiles are in waiting to transport them — in case of the children, to the hospital of the American Red Cross; in the case of adults, to the Casino Hospital; in that of the aged, to the Hospital Clarisses.

2. *Medical Examination on Arrival.*—The convoy is directed to the Casino, where, after the ceremony of reception they pass to the hot shower baths, during which time their clothes are submitted for disinfection by means of steam under pressure in large steam autoclaves.

After having passed to the Service of Identification and Information the *repatriés,* furnished with their necessary tickets, pass one by one the medical service.

a. Medical examination: In the compartments for examination are placed three physicians; one who interrogates the adults particularly from the point of view of tuberculosis and sends the suspects to a special room for auscultation, where they disrobe in the individual cabinets and are then examined and auscultated by a specialist in pulmonary tuberculosis.

b. The second physician, a specialist for children, a member of the staff of the American Red Cross Hospital, examines all the children from the point of view of the condition of the throat, the cervical glands and the skin (to discover the presence of impetigo, scabies, tonsillitis, diphtheria and the eruptive fevers).

c. The third physician submits the *rapatriés* to an interrogation relative to the sanitary conditions existent in the invaded territory.

3. *Redistribution into Hospitals.*—This is as follows:

1. The adults recognized as ill are immediately admitted to the hospital of the Casino; from there they are evacuated after cure or are sent to the hospital of Etrembiéres or the hospitals of Lyons.

2. The tuberculous are directed from the examining rooms, if they are severely infected, to the institutions for incurable cases. If only slightly infected or only suspect, to the Hospital of Diagnosis at Thonon.

3. The children, if they are contagious (diphtheria or acute infections) are placed in a separate compartment and later taken to the American Hospital. If they are infected with scabies or impetigo they are sent for treatment by means of baths, local applications, and the disinfection of their clothes — to the Hospital Annexe Gordon.

4. The aged persons who are incapacitated are sent to a special hospital.

5. A bacteriologic laboratory is installed in the Casino for rapid diagnosis of the infectious diseases.

THE SERVICE FOR THE DIAGNOSIS AND REDISTRIBUTION OF TUBERCULOSIS

We have mentioned above in speaking of the medical examination on arrival that all the adult *rapatriés* are interrogated individually by one of the physicians of the service during the passage of the convoy. He inquires of the person if he has lost weight, and how much; if he coughs at present, or if he has coughed during preceding year; if he has ever had pleurisy; if he has had hemoptyses; if he expectorates, etc.; and finally, if there have been any members of his family who

have presented symptoms in this category, if he has lost any children of meningitis, etc. Any subject suspect is immediately sent to a special room composed of six isolated compartments for disrobing, and furnished with a nurse. Each patient when prepared is taken to the room for auscultation, where a careful examination is made by a physician, specialized on the question of tuberculosis. These examinations have been made during the entire duration of these convoys, from November to the end of February, by Dr. Wapler, the physician to the Antituberculosis Dispensary of Versailles, who, after two years at the front, had been placed during more than six months at the head of one of the sanitary stations of the *Ministere de l'Interieur.* The number of patients thus sent to the examining room varies according to the convoys, from five to twenty.

We have already said that all those patients affected with cavities or with a rapid form, of fatal prognosis, are immediately admitted (except in the case of refusal on their part, sadly, enough too frequent) into two special hospitals for serious cases, especially adapted for this purpose, namely, for men, the Hotel des Princes at Amphion, administered by the *Ministere de l'Interieur;* for women, the Villa Bellevue, at Evian, administered by the *Comité de Lyon.*

Certain cases are, on the other hand, immediately recognized as being entirely normal and presenting no lesion whatsoever, and are therefore authorized to continue on their way with the convoy.

The third category of cases is very important. They are those who present only slight pulmonary signs, with a general state of health more or less bad, which cannot be considered as tuberculous without a more complete medical examination. Except for the cases which refuse hospitalization (the tired *rapatrié* accepts easily to be hospitalized for several days, as a rule) these cases are sent to the Hospital of Diagnosis at Thonon. This hospital has been very well organized by the Society of the Red Cross of Thonon, which was kind enough to place it at the disposal of the *Ministere de l'Interieur* and is being administered by Mr. Henri Bordeaux. It is under the direction of Dr. Narat, a specialist particularly qualified on the subject of tuberculosis, since he has been for a long time assistant at the *Sanatorium de Montigny en Ostrevent,* and then, since the war, assistant physician for more than a year at the Sanatorium d'Augicourt. To these titles Dr. Narat joins personal qualities of the very first order, as well as a wide medical knowledge, especially in the matter of tuberculosis, and a method and faculty of organization.

The sojourn at the Hospital of Diagnosis is at least ten days. During this time the rectal temperature is taken morning and evening, or more often if it is necessary, and a graphic inscribed. The patient is examined at frequent intervals and the stethoscopic signs collected and inscribed on a chart. Finally, the sputum is examined bacteriologically three different times if the original specimen is negative.

Following this period of observation the patient is either considered as latent and may depart with the convoy, or rejoin his family who reclaim him, or, if he is considered as affected with definite pulmonary tuberculosis, he is then placed in one of the following categories:

1. Closed tuberculosis of the fibrous type.
2. Active tuberculosis but still closed.
3. Open tuberculosis — curable.
4. Chronic tuberculosis, with cavities, or a very rapid evolution.

The patient is then directed to an appropriate station, save for the closed or fibrous types of tuberculosis, which are considered non-contagious and for whom a sojourn is permitted in the country (but with *affiche* filled in for the departmental committee for the aid of the tuberculous).

The redistribution is made in the following manner:

For men: Cases of tuberculosis closed or open, but curable, are sent to the sanitary stations of the *Ministere de l'Interieur,* accompanied by a detailed report to the *médicin-chef* of the hospital.

Open tuberculosis, but cavity formation are sent to the Hospital for Incurables.

For women: Early tuberculosis, not open, is sent to Pellevoisin. In cases where women are accompanied by one or more healthy children they may be received with them in a neighboring hotel.

Early tuberculosis, active but closed, are sent to Monnetier-Mornex; their children are lodged at the Hotel Trottet. The open curable forms are sent to Lyons to the Hospital St. Genis Laval, organized for this purpose by the American Red Cross under the direction of Dr. Belis. They may equally well from now on be sent to Monnetier-Mornex.

The open forms with cavity formation or a rapidly progressing condition, to the hospital for incurables at Evian.

It is necessary to note, unhappily, that for the period of observation more than one-third of the patients refuse hospitalization. Since up to the present we have no law permitting us to restrain them, we are obliged to allow them to leave with the convoys and proceed to the locality where they are reclaimed, without even being able to forewarn the family of the danger which it will run, since we are tied by professional courtesy. But the patient receives a small pamphlet

indicating to him the precautions necessary to take for himself and for his immediate family. An analogous pamphlet directed to the family is handed to some member. Beside that, a special form is filled in and addressed to the *Préfet* of the department to which the patient is directed, and this in turn is handed to the physician of the departmental committee of hygiene.

Aside from pulmonary tuberculosis, we receive a certain number of cases of osseous, glandular and peritoneal tuberculosis. These cases for adults are also placed for observation in the Hospital of Diagnosis, from which place they are distributed in the following manner:

Osseous tuberculosis to Berck sur Mer — for the men.
Glandular tuberculosis and other forms in men, also to Berck sur Mer.
For the women the hospital at Monnetier-Mornex, where we have installed a system of heliotherapy according to the method of Rollier, who has been able to secure such remarkable results.

For the children, they are first placed under observation at the American Hospital at Chatelet, from which the severe osseous forms (*coxalgie*) are sent either to Berck sur Mer, or to Cannes where there is the heliotherapeutic clinic of Dr. Vognard, which has been subventioned by the *Comité de Lyon.*

The glandular or osseous forms which do not require recumbent treatment are sent to Sylvabelle, organized at Cavalaire by the *Comité de Lyon.* It is a hospital of 100 beds under the direction of a specialist in heliotherapy, Dr. Rivier.

In the course of a recent inspection we have been able to prove the most remarkable results in *rapatrié* children received only six weeks previously.

We will open in the very near future at Monnetier-Mornex another hotel which will be dedicated to the forms of local tuberculosis, and suitable for heliotherapy.

From the month of October to the 26th of February the service of diagnosis and redistribution of the tuberculous furnishes the following figures:

Total adults 60,936. Children, 37,554.
Adults examined in the clinic and in the Casino, 1,145.
Recognized as infected or suspect, 661.
Sent to the Hospital of Diagnosis, 564.
This results in the proportion of tuberculosis for the adults of a little more than 1 per cent.
Children admitted to the American Hospital for Tuberculosis, 98.

This number is relatively very small; it should be at least double. A number of parents refuse to allow treatment of their children at

the hospital, except for an active infection, and will not allow treatment except for pulmonary or local tuberculosis. This number does not include the tracheobronchial adenopathies which we have not been able systematically to search for, the necessity for rapid passage of the convoy not permitting of an auscultation of all the children. This makes for the children a proportion of tuberculosis in the neighborhood of 3 per cent., based on the figure of hospitalized cases. Admitting those refusing hospitalization, the figure could easily be 0.6 per cent.

SERVICE OF PROPHYLAXIS AGAINST CONTAGIOUS DISEASES

Medical Examination of the Rapatriés of the Convoys, and of the Hospital for Contagions for Children.—This service is one of the most important, for it attempts to prevent those cases infected with contagious diseases from being allowed to contaminate the convoys of evacuation and ultimately their new residence. It naturally is particularly the responsibility of the medical service, and especially that of the children. In fact, before its creation a grave epidemic of diphtheria was encountered, because of the children infected in Belgium among the children of many convoys redistributed into the various departments and particularly in an orphanage in Lyons.

The service was created with the aid of Dr. William Palmer Lucas, chief of the Children's Department of the American Red Cross, and of his assistant, Dr. C. F. Gelston, physicians of great competence, both as regards medicine and of infantile prophylaxis; distinguished scholars, as well as men of heart and devotion. With the aid of these two physicians we have been able to realize a service as perfect as is possible with the conditions created by this floating population, which passes each day with more than 500 children, having been transported for many weeks under an absolute promiscuity and under the worst possible conditions of hygiene.

The adults, as we have said, are interrogated by a physician as to their state of health, and if there has been an illness they are offered a complete physical examination. On the other hand, it is very rare that they present the condition of a contagious disease.

For the children the question is different. As regards them, they can very rarely give any information as to their condition, and, moreover, they have seldom acquired the immunity against the eruptive fevers and infectious diseases; therefore, arriving very often infected with acute conditions, with diphtheria or incubating an eruptive fever,

without counting the parasitic dermatitides, particularly scabies and impetigo, which are very frequently the result of the crowded conditions under which they have been obliged to live in Belgium. It is necessary, therefore, that each child should be subjected to an individual examination as complete as possible. Because of the necessity of a rapid passage of the convoy, it was considered impossible completely to undress a child for this examination. Nevertheless, we have succeeded in securing a maximum of protection. Each child is held by a nurse for examination by a specialist (this physician has almost always been Dr. Gelston, who during the months from November to March has himself examined more than 25,000 children). The total number of children examined has been 37,550. The physician, after having made a rapid general observation of the child, examines his throat and mouth by means of individual tongue depressors, then palpates the cervical glands and examines carefully the condition of the skin of the neck, hands and forearms. Thanks to this investigation, it is possible to discover not only an acute tonsillitis, diphtheria or scarlet fever at its onset, but also measles, varicella, without mentioning scabies and impetigo. I may add that if a child has a fever or coughs, he is undressed and examined, or more often is immediately sent for a period of observation to the hospital. Each child infected with a contagious disease, or simply suspect, is immediately placed with his mother and his brothers and sisters in an isolated compartment. He is then taken by a nurse who conducts him at once to the hospital or to the Annexe Gordon in one of the American ambulances.

Operation of the American Hospital at Chatelet.—The organization of this hospital in which we have been very happy to have found ourselves entirely in accord, from a scientific point of view, with our eminent American colleagues, has been made on the principle of isolation for each child in an individual cubicle, following the method originated by our Professor Dr. Grancher, and which is applied today not only at the hospital of the Pasteur Institute, but in the greater part of the children's hospitals of Paris. Since the necessary installation was improvised in a hotel which had no special facilities, only the materials available could be used. Thanks to the ingenuity and ability of Mr. W. C. Stevenson, the administrator of this hospital, the rooms of the building were very easily divided into from three to five cubicles by means of linen curtains 1.5 meters long, suspended from metallic wires and fixed to the floor by rings and ties. In each cubicle is installed a bed and a table with the objects and utensils

necessary for each little patient. A gown is hung at the entrance of each compartment, which is put on by the nurse to care for each child, and finally, an antiseptic solution placed in a convenient location, permits the nurse to wash her hands before approaching the patient and after having cared for him.

The hospital is composed of three floors; the first has been reserved to feeding cases and to noncontagious affections. The two others have been divided into different divisions for the contagious diseases, the divisions for diphtheria and measles being the most important. Each one of these divisions is separated in such a way that the personnel may be easily kept distinct. Also by means of this cubicle system and by means of the facility of disinfection, it is comparatively easy, according to circumstances, to add one or more rooms to any particular ward.

The disinfection of the utensils and dishes from the wards is secured by boiling in special apparatus in the kitchen. The disinfection of the gowns and the linen is secured each day in the large autoclaves at the Casino, which functions each day for two hours after the morning convoy especially for this purpose.

Visits of the parents, daily during the first two days, are after that authorized only twice a week. In order to enter the hospital the parents are obliged to wear a gown, previously disinfected, and cover the head with a linen cap, which, together with the gown, is afterwards disinfected. They are allowed to go only to the bed of their child.

Pavilion for Observation.—The hospital has installed a division of the service to place under observation during a period of twelve days all of the orphan children received at the Villa des Lilas by the Lyons committee, and destined for the orphanage of Madame Gillet-Motte at Lyons. By this means they have been able to prevent the introduction into this establishment of those children incubating infectious diseases.

Thanks to all these measures, we have been able to treat in the same building numerous cases of measles, diphtheria, scarlet fever, etc., with a certain number of cross infections, but absolutely minimum, since their proportion has not reached 2.5 per cent. Certain of these cases of measles were produced through a nurse who had contracted measles and had transmitted it to several children during the period when she presented only the coryza of invasion. We had in March a certain number of cases of bronchopneumonia, but the fatal cases have only numbered eleven. This makes, with 228 cases of measles treated

from the 5th of November to the 31st of March, a mortality of 4.8 per cent. To the 1st of April the American Hospital has treated 1,314 children divided as follows:

1. Total children admitted to the hospital from November 5 to March 31		1,314
2. Diagnostic summary.		
Contagious service:		
Measles	203	
Mumps	18	
Scarlet fever	41	
Diphtheria	97	
Whooping cough	69	
Chickenpox	46	
Tuberculosis	98	
Total		572
Noncontagious service:		
Bronchitis, acute and subacute	59	
Bronchopneumonia, primary	28	
Bronchopneumonia, complication	17	
Fatigue	35	
Feeding cases	25	
Skin affections	95	
Cardiac affections	6	
Nervous affections	15	
Eye affections	18	
Ear affections	18	
Gastro-intestinal affections	39	
Fatigue myositis	19	
Trauma	12	
Observation	250	
Total		619
Various other conditions		123
Grand total		1,314
3. Statistics of deaths:		
Bronchopneumonia after measles	11	
Bronchopneumonia, primary	7	
Erysipelas	1	
Cardiac affections	2	
Whooping cough	2	
Tuberculosis, pulmonary	1	
Tuberculosis, miliary	1	
Septicemia	1	
Diphtheria, laryngeal	1	
Respiratory paralysis, postdiphtheritic	1	
Scarlet fever	2	
Total		31
4. Dispensary:		
Number of cases treated:		
General dispensary	912	
Dental dispensary	678	
Total		1,590

Isolation and Treatment of Cases of Impetigo and Scabies.—Cases of impetigo and scabies are very numerous, especially among the first of our *rapatriés.* When one of the members of a family is infected, all of the family in general is more or less contaminated, so that we receive the entire family in a hospital especially designed for their cure and so designated by the *Ministere de l'Interieur.* This is the hospital the Annexe Gordon. It consists of 180 beds, 15 bathrooms, 4 massage rooms and a service for disinfection by means of sulphur. All the patients infected with scabies take sulphur baths, after which they submit to an injection, in the case of adults, of Ellmerich ointment, and for the children, Balsam of Peru. The average duration in this hospital for scabies is six days. From October to the end of March there were treated 2,828 cases of scabies.

Impetigo is treated by thorough cleansing, and by cutting the hair if the head is affected, and an application of zinc oxid. The number of cases treated is 234.

Thanks to these measures, we have practically suppressed scabies among the *rapatriés.* The cases of recurrence have been very exceptional; certain *rapatriés* waiting in the district have been obliged to return to the Annexe Gordon to submit to another treatment, but no department has notified us of the presence of scabies among *rapatriés* arriving by convoy.

MEDICAL ASSISTANCE AND HYGIENIC SUPERINTENDENCE OF RAPATRIÉS IN WAIT

Daily Medical Report.—In the three waiting centers, Evian, Thonon and Annemasse, a complete medical service is organized; information about it is given by way of a notice posted in all hotels. It comprises:

1. A daily consultation department.
2. A visiting department, at home, at the hotels and at the lodgings.
3. A day and night emergency service, each of the doctors taking his turn for the week.
4. A visiting nurses' department, supplied by the A. R. C.
5. A disinfection department.

When there is a case in the town, the printed request is brought, through the lodger's care, to the medical station where it is given at once to the doctor in attendance.

For *rapatriés* living in neighboring villages, a telephonic message is sent by the postoffice and the doctor in attendance goes immediately with an ambulance of the American Red Cross.

We shall never extol too much the services rendered by the automobile section of the American Red Cross, which always keeps in permanence for emergencies two cars near the medical station.

There are at present four Nurses for Annemasse, and when there are new convoys, there will be ten for Evian.

COMMISSION OF PATIENTS' DIVISION EVACUATIONS

So far as to avoid mistakes, and in order to coordinate the division of patients, the doctor in chief assembles every week, at least once, and sometimes twice, according to emergencies, the physicians of the different hospitals, as well as the delegate of the Lyons committee and one representative of the administrative service.

Propositions for placing sick in hospitals for tuberculosis, sanatorio, special services (ophthalmology, urine functions, nervous system diseases, insane asylums, etc.) have been previously made up.

The division of the different cases is then made according to the free places in the different foundations (which have been previously stated).

The organization and date of convoys are then arranged in agreement with the delegate of the Lyons committee and the administration representative. A list bearing the dates and time of departure, together with indication of the destination, is addressed to the doctors of the different formations for execution; a copy of those lists is kept in the records rolls so as to allow the date of departure and the formation in which such or such patient may be easily found.

The evacuation of patients toward different destinations is made in special sanitary cars, kept at the Red Cross; disposal by the P. L. M. Line; those cars are specially fitted up by the care of the Lyons committee, who supply nurses to accompany the patients to their destination. I must add that those nurses (S. B. M. from Paris) start from Annemasse and accompany to Paris the trains of *rapatriés* bound for that destination, to whom are added the sick for Berck.

ASSISTANCE TO THE RAPATRIÉS

The object of the Committee of "Assistance to the *Rapatriés*" is to bring its cooperation to the service of the State for a national work of great importance. It was founded in April, 1917, through

the initiative of Mrs. Ed. Gillet-Motte and Mr. George Cabaud, at Lyons and Evian, for the object of helping all *rapatriés,* and chiefly women and isolated children.

Isolated Children.—Children arriving alone at Evian are either orphans, forsaken children, or children that the horrors of war have removed for a time from their families. They are entrusted to the committee for their care by the Home Ministry.

At Evian they are welcomed at the Villa des Lilas, specially arranged for them, and thence they are sent to Lyons, 2 Boulevard des Belges, the seat of the committee, where they are taken care of, cleaned and clothed.

The larger children, over 13 years, if they are not ill, are placed for wages, chiefly in the country, with a contract and insurance against work casualties. Every three months their wages are gathered and put in a savings bank.

Young girls are sent to a domestic school at Charbonnieres, near Lyons.

Young boys also go to a home where they may learn a trade, such as carpenter, blacksmith, shoemaker, etc.

The other children are sent to different establishments where they are instructed in all necessary branches, instruction being greatly neglected in the invaded districts.

The little ones (between 2 months and 2 years) are placed in a nursery. They receive medical visits very frequently.

Sick children are sent to the American Red Cross' hospitals, at the Chateau des Halles, to Doctor Grulee's hospital on the Cours Gambetta in Lyons, or else to the sanatorium of Sylvabelle, on the Mediterranean, fitted up by the care of the Committee of Assistance to the *Rapatriés* and for which the American Red Cross has supplied a generous contribution.

When children have again found their families, they are given back to them, after authorization by the Préfecture du Rhone.

Thus, between February and November, 1917, more than 1,000 isolated children have been cared for; 400 isolated children have been given back to their families; 150 isolated children over 13 years have been placed for wages; 1,400 isolated children have been placed in the colonies organized by the committee.

Aged Repatriés.—The Committee of Assistance to the Rapatriés has hospitalized more than 1,500 old persons at the *"Petites Soeurs des Pauvres."*

Lodgings for Numerous Families. — Before the American Red Cross had sent to all the French departments delegates who visit the refugees and *rapatriés* and give them help, the Committee of Assistance to the *rapatriés* had placed in excess of 200 families in lodgings left to their disposal, in the Lyons suburbs. Social workers regularly visited those families.

Now the committee delegates at Evian designate to the American Red Cross delegates the most needy families in the department to which they are sent.

As a final word I should like to express my profound appreciation in the name of France, as well as that of my immediate personnel, for the services rendered by the American Red Cross at Evian, and throughout France, for our poor repatriated citizens. At Evian, itself, through the installation by the Children's Bureau of their well organized hospital it was possible to save a number of children, and especially to prevent the dissemination of a large number of infections into the interior.

THE MASSACHUSETTS CHILD CONSERVATION COMMITTEE: THE DETAILS OF ORGANIZATION AND WORK

RICHARD M. SMITH, M.D.
BOSTON

Child conservation has become recognized so definitely as a part of the national war activity in foreign countries that no discussion of the importance of this work as a war measure is necessary. The Federal Children's Bureau with the endorsement of the President has designated this second year of the war as "children's year," and has published a program to be followed throughout the country. The method by which the work is to be accomplished is left to the various states to decide for themselves. Massachusetts has been working for the past year on child conservation. It seemed to me that it might be worth while to discuss at this time the methods employed, since they represent the distinctive feature of the work in each state.

ESTABLISHMENT OF COMMITTEES

On May 26, 1917, Dr. Allan J. McLaughlin, the Commissioner of Health, appointed from the Public Health Council, which is the advisory body of the state department of health, two members to serve with the director of the Division of Hygiene as a committee on child conservation. He also appointed an advisory committee of persons in the community particularly interested in children. The members of the committee are Drs. David L. Edsall, William J. Gallivan and Lyman A. Jones; of the advisory committee, Drs. Fritz B. Talbot, Robert L. De Normandie, Walter E. Fernald, William Healy, Richard M. Smith, Mrs. W. H. Lothrop, Miss Gertrude W. Peabody, and Miss Mary Beard. The distinction between the committee and its advisory members was never drawn sharply and from the first the two committees have met together and the actions of the joint body have been final. The advisory members have had equal authority with the members of the committee itself. This is an important detail as it indicates the spirit with which the work was undertaken by the officials of the department of health.

COOPERATION AFFORDED BY THE COMMISSIONER OF HEALTH

The commissioner at the beginning told the committee that he felt very strongly the urgency of child conservation particularly as a war measure and that he was anxious for the department of health to accomplish as much as possible in this part of its war work. He left the committee with a perfectly free hand to work out its plan of action and to put that plan in operation. At every stage the commissioner has been ready to give time, advice and encouragement and he has done everything in his power to put the machinery of the department at the disposal of the committee. Massachusetts owes an everlasting debt of gratitude to him for his farsightedness in recognizing the importance of child conservation and for his deeds which have made the work of the committee effective. A few weeks ago Dr. McLaughlin was called back into the public health service. Dr. Eugene R. Kelly, the new commissioner, is furthering the work started by his predecessor with uninterrupted interest and we are equally grateful to him.

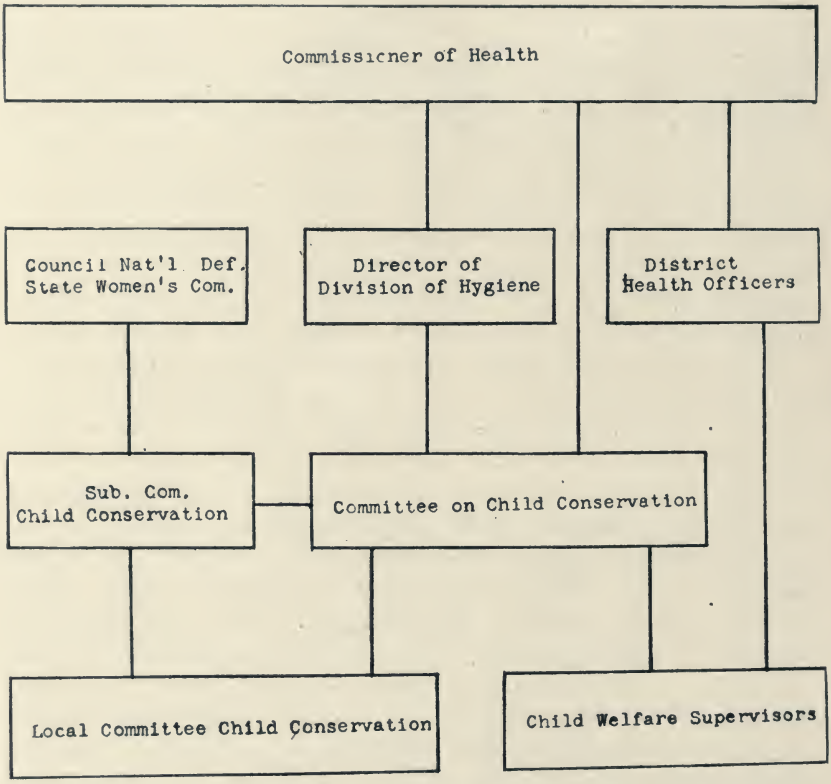
ADVANTAGES OF COOPERATION WITH THE CIVIL AUTHORITIES

This plan of doing child conservation work by a committee of the department of health has a certain advantage over the formation of a committee under some strictly war organization, as a public safety committee, in that it is in such close touch with the health department, and whatever is accomplished in tangible form may be embodied permanently in the machinery of the state department.

An important feature in the make-up of this committee is the combination of public officials and private individuals working together in a group which is more or less independent of all other groups and yet part of a state department. Many advisory committees have been formed in other connections, but this committee is in theory advisory, but, owing to the attitude of the commissioner, in fact, authoritative. The personnel of the committee is instructive as showing the variety of interest concerned and the different angles from which the questions are approached. There are two pediatrists, an obstetrician, a public health nurse, the superintendent of a state school for feebleminded, the physician in charge of the Boston Juvenile Court and the director of civilian relief of the New England division of the Red Cross. This is a medical committee and puts the responsibility for this work on us. Meetings of the committee have been held once a week since Aug. 1, 1917, and the attendance has been extremely regular.

EVIDENCE OF COOPERATION

A further evidence of cooperation is seen in the action of the women's department of the Council of National Defense. This department is represented in Massachusetts by a woman who is anxious that their child welfare work shall be in closest touch with the work of the State Committee. Therefore, she appointed as chairman of her


Commissioner of Health
Council Nat'l Def. State Women's Com.
Director of Division of Hygiene
District Health Officers
Sub. Com. Child Conservation
Committee on Child Conservation
Local Committee Child Conservation
Child Welfare Supervisors

SCHEME OF ORGANIZATION OF THE COMMITTEE ON CHILD CONSERVATION

Child Welfare Committee, Miss Mary Beard, who was already a member of our state committee, and as vice-chairman, Miss Gertrude Peabody, who has attended our meetings regularly and for all practical purposes has been a member of the committee. We have then on our state committee through its various individual members, representatives of the state health department, of the Red Cross, of the

Council of National Defense and individual physicians in the community most interested in child conservation and having particular interest in special departments of that work.

ORGANIZATION OF THE HEALTH DEPARTMENT

It is necessary to say a word about the organization of the Massachusetts Department of Health. The commissioner has under him eight district health officers who preside over the eight health districts into which the state is divided. In each of these health districts the health officer is practically a deputy commissioner, although all authority for work comes directly from the commissioner. For each one of these health districts the Child Conservation Committee appointed a public health nurse known as a Child Welfare Supervisor. These nurses were selected with the greatest care, and all of them had had not only public health training, but a considerable amount of experience in actual public health field work for children. It is hard to overstate the contribution made by these nurses. They have brought to the committee wonderful enthusiasm, expert knowledge, keen judgment and constructive suggestions. Without them the committee would have been able to do comparatively little. They are responsible directly to the committee but work in close touch with the district health officers. They are in fact introduced by them in the various communities to which they go.

SCOPE OF THE WORK

The first interest of the committee was to secure the facts in Massachusetts so far as child welfare work was concerned; to determine the number of children, the birth rate, the death rate and the facilities for taking care of children in each community. Therefore, we have made through these nurses surveys of the various cities and towns. To secure the facts the nurses have visited the representatives of the board of health, the child welfare agencies, the visiting nursing associations and other private or church societies which were doing child welfare work. They have received also first-hand information by personal investigation concerning the actual work being done by these organizations. From these facts the supervising nurses have made to the committee certain recommendations which seemed to them the desirable things to be done in that community for child conservation. The survey with the recommendations has been sent also by the nurses to the district health officers.

FREQUENT CONFERENCES HELD

Usually the nurses and the district health officers have discussed the situation together in conference. The district health officers have made whatever comments they saw fit on the surveys and on the recommendations and then have forwarded them to the commissioner of health. A copy of these letters and reports has been sent also to the committee. The committee has gone over in detail each survey with the nurses' recommendations and the district health officers' comments. The nurse who made the survey has been present at the meeting and frequently also the health officer of the district. The committee has adopted then certain recommendations which seem to them desirable in view of all the facts with reference to that particular community. The secretary of the committee then has written to the community a letter stating the recommendations and urging that efforts be made to carry them out and offering the advice and help of the committee to that end. The commissioner of health at the same time has written a letter to the local board of health in that town or city calling attention to the fact that the survey has been made, sending him a copy of the statement of facts and of the recommendations which have been made by the committee and urging that the local board of health do everything it can to help put the plan into operation.

SUGGESTIONS MADE FOR IMPROVING THE WORK

In the recommendations of the committee and the commissioner we have called sometimes for an extension of the work of the local department of health, sometimes for the addition of more nurses by the Visiting Nursing Association, and sometimes for the providing of free obstetrical beds in hospitals. Almost invariably we have urged more prenatal work, either by the addition of prenatal clinics or the extension of nursing service, and also invariably for the supervision of well children from birth up to 5 years of age, and not infrequently in connection with this the establishment of well baby clinics. We have asked also that outpatient departments be established to which sick children could be brought for treatment and sometimes that a children's ward be built in connection with a general hospital. We have endeavored to see that prenatal care, good obstetrical care and postnatal care from birth up to 5 years of age is provided for every child.

PUBLIC HEALTH TRAINING FOR NURSES

We have insisted everywhere on the necessity of public health training for nurses doing this work. The secretary early last year wrote a letter to the State Nursing Association urging them to impress on all the nursing organizations of the state the importance of keeping the standard of public health nursing high.

PUBLICITY AN IMPORTANT ADJUNCT FOR SUCCESSFUL RESULTS

We have tried further to stimulate local publicity both for the raising of funds to carry on the work and for the awakening of interest in the importance of child conservation. We have had a person giving half time to directing newspaper publicity. Also many public meetings have been arranged at which talks have been given. Members of the committee have spoken at twenty-three such meetings and the supervisors at 136 meetings. We have reached at least 10,000 people by this means.

CONCENTRATION BECAME NECESSARY

When the committee first started we tried to include all parts of the child conservation program, that is, infant care, school hygiene, juvenile delinquency, child labor, day nurseries, and similar agencies. We found, however, that this was such a large program that our energies would be too scattered unless we localized our efforts. We decided that for the first year we would receive the largest return by concentrating on the care of the child up to school age. We have digressed from the usual procedure, however, in many instances, and have made special recommendations which seemed to be urgent in a particular locality. For instance, in some cities the day nursery situation was acute, and we have aroused the local community through our supervisors to take action in the matter. We hope later to study this whole subject in a broader way with the possibility of legislative standardization.

ILLEGITIMACY AND VENEREAL DISEASE

We have been interested in the question of venereal disease and illegitimacy as it affects children and is made of particular importance by the war. The Massachusetts State Department of Health has this year made syphilis and gonorrhea reportable diseases and in this connection has started a very active campaign of general education.

Our committee has been cooperative so far as we could be in this plan, but the work of the department of health has made it unnecessary for us to act independently in this particular.

DELINQUENCY IN CHILDREN

The question of juvenile delinquency is now becoming, because of the war, a definite increasing factor in child conservation work. We are doing already what we can to collect facts regarding it. We hope later to make definite recommendations for its control.

CARE OF THE OLDER CHILDREN

The care of the school child in the larger cities is a big enough study to demand an independent investigation, and we have not considered it there? In the smaller communities, however, the number of schoolchildren is not large and is intimately connected with the other parts of public health work. In these places we have made specific recommendations with reference to school nursing, dental care, preventive and follow-up work.

LOCAL COMMITTEES ON CHILD WELFARE ESTABLISHED

A very important feature of the state work has been the formation of local committees. The child welfare vice-chairman of the women's department of the Council of National Defense, Miss Peabody, working with the child welfare supervisors, has organized in the various cities and towns of the state local committees on child welfare. These committees have for the most part been independent of any local organizations except for the Women's Council of National Defense, and have included in their membership representatives of the local boards of health, of the local physicians and of agencies interested in child welfare. We have found that by creating this independent body it has been possible to bring together many persons and organizations which formerly had been working at cross-purposes or in actual opposition.

COOPERATION THE SECRET OF EFFICIENCY

Whatever success has been attained in Massachusetts has been due in no small measure to the efficiency of this part of the work. Miss Peabody has given practically her entire time since September to this and has gone all over the state organizing the local committees. Up

to date 183 such committees have been formed. There have been held several large meetings in Boston and elsewhere during the year by the chairmen of these local committees. At these meetings questions of policy and method are discussed and a great deal of enthusiasm fostered. It is to these committees that the recommendations from the state committee are sent. There are still a few towns under 6,000 inhabitants where local chairmen have not yet been appointed, and there are a good many rural communities in which practically no work has been done. It was impossible to make surveys of these rural communities during the winter, but we hope this summer to do something toward arousing interest in child welfare and in working out a plan of action for them.

KEEPING A RECORD OF RESULTS

The recording of results is difficult. Organized child welfare work is not new in Massachusetts. The department of health has been working on child conservation, and some local committees have been doing effective work for many years. The seeds of our work the last year, therefore, have fallen on ground already partly prepared. Often the work of the state committee has served largely to crystallize sentiment on the need of this work and has helped the local boards of health or private organizations to accomplish things which had been desired for a long time. But in some places nothing at all had been done for children and the local health officials had given no thought to the matter. Here we worked on virgin soil. In almost every instance throughout the state the suggestions made to the local boards of health and to the private organizations and individuals have been received with enthusiasm. A spirit of cooperation hard to overcommend has been manifested by everybody. All have worked together for the benefit of the children. Much more has been accomplished than it is possible to record in figures because of the statewide interest that is now manifest in child conservation. The activities of the local committees are now so great that our difficulty at present is to keep in touch with all that is being done and to give the assistance which is constantly being asked.

We know, thus far, that thirty-one new public health nurses are to be employed by the boards of health and private organizations to do child welfare work. Some of these are already at work. Eleven new infant welfare stations have been opened in six cities and nine

prenatal clinics opened in six cities. A considerable number of others are to be opened in the near future. A free bed has been secured in one hospital to be at the disposal of the Child Welfare Association in that city to use for cases needing hospital care. Several new organizations for child welfare have been formed — one in a locality where previously nothing had been done in any kind of public health work. The nursing personnel has been changed in several places with the appointment of trained public health nurses. In two cities we have loaned one of the supervisors to take charge at the beginning to direct this reorganization. Approximately $50,000 has been provided since Jan. 1, 1918, for new child welfare work.

General interest has been aroused in the care of the child from one to 5 years of age. Most of the infant welfare associations are extending their work to include this period.

RESULTS OF THE YEAR'S WORK

This year's work in Massachusetts has demonstrated two things which have an application quite beyond the limits of the state. (*a*) A workable method of cooperation between public officials and private organizations and individuals. This method requires for success an appreciative spirit in the public officials for the enthusiasm and desire for results inherent in private workers, and a tolerant sympathy on the part of the layman for the necessary conservatism of official action. (*b*) The universally favorable response which comes from every community when an opportunity is presented for constructive and definite work for children.

During the year we have found many interesting facts of a technical nature which may be reported on at a later date.

The form of survey and scheme of organization is appended.

329 Beacon Street.

FORM OF SURVEY

I.

Name of city or town.
Area:
Population:
Chief nationalities:
Industries:
Number of births for..... Birth rate:
Number of deaths under 1 year..... Infant mortality rate:
Number of deaths between 1 and 5 years.....
Department of health:
Prenatal work:

Baby welfare work:
Supervision of child of preschool age:
Other nursing agencies:
Hospitals:
Other child saving agencies:

II.

Housing conditions:
Water:
Milk:
Schools:
Factories:
Garbage:

III.

Deaths by ages	Deaths by ages
1 day and less.	7 months to 8 months.
1 day to 1 week.	8 months to 9 months.
1 week to 1 month.	9 months to 10 months.
1 month to 2 months.	10 months to 11 months.
2 months to 3 months.	11 months to 12 months.
3 months to 4 months.	1 year to 2 years.
4 months to 5 months.	2 years to 3 years.
5 months to 6 months.	3 years to 4 years.
6 months to 7 months.	4 years to 5 years.

Seasonal distribution of deaths: Under 1 year. One to 5 years.

Causes of death: Under 1 year. One to 5 years.
Congenital
Respiratory
Intestinal, etc.

Deaths by nationality—using birthplace of mother:

Maternal deaths:
Cause. At home or hospital Physician or midwife.

IV. Notes:
Comments by nurse on local situation.

V. Recommendations:

DISCUSSION

DR. LA FÉTRA: Dr. Smith is certainly to be congratulated on his success in coordinating the various welfare agencies and getting them to work harmoniously with the public health officers.

DR. HAMILL: I wish to say something about child welfare work in Pennsylvania. It took us a long time to establish a satisfactory plan of cooperation with our State Department of Health. In the beginning of the work of the Child Welfare Division of the Committee of Public Safety a great deal of time was devoted to eliminating or absorbing agencies which were organizing for statewide work in child welfare, and in working out a satisfactory plan of cooperation with the Child Welfare Department of the Pennsylvania Division of the Woman's Committee of the Council of National Defense. This latter point was accomplished by establishing but one child welfare committee for the entire state and one child welfare committee for each county in the state, the single committee representing both agencies. This organization desiring the cooperation of the State Department of Health, worked out with the department

the following organization for the conduct of child welfare work in Pennsylvania: The State Department of Health established a Division of Child Hygiene. The Director of Child Welfare for the Committee of Public Safety of Pennsylvania, acting with the Pennsylvania Division of the Woman's Committee of the Council of National Defense, was made chief of this new division with the understanding that the work which had been planned and developed by the committee representing the Committee of Public Safety and the Woman's Committee should become the plan of procedure for the new Division of Child Hygiene. In other words, the work for the welfare of children in Pennsylvania is directed from the Division of Child Hygiene of the State Department of Health, cooperating with and working through the state and county committees of child welfare created by the Committee of Public Safety and the Pennsylvania Division of the Woman's Committee of the Council of National Defense.

This plan of organization gives us the moral and financial support of the State Department of Health, which is indispensable to efficient work in the state. The Commissioner of Health has authorized the employment of nine public health nurses, two of whom are to aid in the organization and development of work of the committees throughout the state, one of whom is to serve as an itinerant educator of volunteers, the remainder to do investigative work in the counties. In addition to this force we have the assistance of the health officers of the department in all of the counties, and, in case of emergency, when special investigations are desired quickly, the assistance of the tuberculosis nurses who are located in all of the counties of the state.

Realizing the absolute necessity of the extensive use of volunteers and the importance of giving them some preliminary training, we have established certain centers in the state in which this training can be given. Having discovered that there are many women who are willing and competent to do volunteer work if trained, who cannot afford to leave their homes to secure the training, we have created the position of itinerant educator. This itinerant educator will go to the counties and give courses to volunteers in some one or several of the cities or towns of the county in which child welfare clinics have been or will be established. The course of training to be given by this educator is being worked out by the Committee on Child Welfare for the State of Pennsylvania.

We have been making surveys of several of the cities of the state similar to and based on the surveys which have been carried on in the State of Massachusetts. The surveys are being made for the same purpose and the results are being used in the same manner.

DR. TALBOT: I want to emphasize one point that Dr. Smith brought up, and that is in reference to the $50,000 which was raised as a result of the surveys. I want to make clear how that $50,000 was obtained. As an example, one small town was found to be spending two cents per capita on public health work. Interest was aroused that extended through the town and a town meeting was called and the nurse was asked to present her case. This she did, with the result that the town gave $500 for the work. This $50,000 represents both money raised by local committees and money appropriated by local boards of health.

DR. HAMILL: It is surprising the ease with which the average business or professional man, who has had no previous knowledge of child welfare, can be interested in the subject if it is put up to him with some clearness and

punch. The present offers a rare opportunity to educate lay people as to the importance of this work.

DR. LANGLEY PORTER: It is undoubtedly true that by enlisting the aid of women's clubs and other such organizations in the Child's Year Crusade, the Bureau is using a very vital and important force. It seems to me that this section might put itself on record as expressing its appreciation of what has been done, and as desiring to cooperate. But we should also add that we consider it imperative that leadership and guidance in this and all other infant welfare work should come from physicians who are interested in obstetrics and pediatrics. However, there must be thoroughgoing cooperation, and all available forces must be enlisted. The profession is prone to develop its infant welfare work too largely on the side of medicine and to overlook the more important sociological elements in the problem. The greatest need we have is to educate the community in the fundamentals of child conservation, and we ought to use every effort to have incorporated in the high school courses in physiology simple facts about the physiology of childbirth, the hygiene of the child, and the most elementary principles of nutrition in infancy and childhood.

DR. SMITH: In another small community where we made a survey, one business man who had hitherto not been particularly interested in philanthropic work asked the privilege of making the motion for the appropriation of $1,000 which the town voted.

STUDIES OF INFANT FEEDING. XI

HIGH PROTEIN FEEDING VERSUS HIGH CALCIUM ABSORPTION AS THE CAUSE OF THE INCREASE IN BODY TEMPERATURE OF INFANTS *

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INTRODUCTION

We have found the excessive calcium content of cow's milk to be a disturbing factor in many of the so-called cases of malnutrition and, as any high protein food made under ordinary conditions from cow's milk will of necessity have the greater part of the protein present as calcium caseinate, it seems to us that although protein was the apparent cause of the toxic condition resulting from the feeding to infants of a high protein milk, the real cause might be due to the calcium chemically combined in the calcium caseinate.

We have also found that the feeding to infants of large amounts of pure protein (ash-free paracasin) does not produce any unfavorable symptoms even when the protein is fed with an extremely small amount of whey.[1] As this finding may seem to be contrary to the observations of others we have continued our investigation in an endeavor to find the factor responsible for this difference.

Our investigations have shown that the reduction of the intake of inorganic salts to a point at which chlorin-free urine is eliminated resulted in a febrile condition only when large amounts of calcium was fed as calcium caseinate. We explain these observations as follows:

Under normal conditions sodium can be excreted by the kidneys as chlorid, phosphate, carbonate or sulphate while calcium can be excreted only as chlorid or acid phosphate, the phosphate being only sparingly soluble. A reduction in the intake of chlorin or phosphorus, that is to say, a reduction in the intake of whey, will not interfere with the excretion of sodium because it can form a soluble carbonate, but under the same conditions the excretion of calcium is seriously interfered with and results in an accumulation or retention of calcium

* From the Boston Floating Hospital Laboratories.

1. Bosworth, A. W., and Bowditch, H. I., and Ragle, B. H.: Casein in Infant Feeding, AM. JOUR. DIS. CHILD., 1914, **8**, 120.

until a toxic condition is finally reached which results in a febrile condition accompanied by the excretion of large amounts of calcium lactate in the urine. This excretion of calcium relieves conditions temporarily, or until the calcium retained again reaches the danger point, when there will follow another fever and an increased elimination of calcium lactate. This condition is relieved by the ingestion of whey which furnishes chlorin for the elimination of the accumulated calcium as calcium chlorid.

A careful scrutiny and analysis of the conditions surrounding the data presented by Holt, Levene, and others,[2] and the data secured by us in some preliminary experiments has led us to investigate the following conditions in infant feeding:

1. The reduction of the intake of inorganic salts to a point which results in the elimination of:

(a) A chlorin-free urine.

(b) A chlorin-free and phosphorus-free urine.

(c) A chlorin-free urine accompanied by the ingestion of large amounts of sodium caseinate.

(d) A chlorin-free urine accompanied by the ingestion of large amounts of available calcium as calcium caseinate.

2. The ingestion of large amounts of calcium caseinate accompanied by the ingestion of large amounts of milk salts.

In presenting the results obtained we have selected the data from one experiment under each of the headings given above.

I. THE REDUCTION OF THE INTAKE OF INORGANIC SALTS TO A POINT AT WHICH A CONTINUED EXCRETION OF CHLORIN-FREE URINE IS PRODUCED

The investigation began with the admission of the baby to the hospital on July 9 and may be divided into six periods as follows:

First Period, 6 p. m., July 9, to 6 p. m., July 12.—From 6 p. m., July 9, until 10 a. m., July 11 (forty hours), the child received only sterile water. From 10 a. m., July 11, to 6 p. m., July 12 (thirty-two hours), the food consisted of a mixture of 840 c.c. of whey, 420 c.c. of breast-milk and 420 c.c. of water and was divided into ten feedings. The child was on the metabolism frame during all three days.

The high output of uric acid, creatinin and creatin during the fast indicates a high endogenous metabolism and is followed by a higher excretion of these substances on the administration of food; the excretion of nitrogen, however,

2. Holt, L. E., Levene, P. A., and others: The Influence of High Protein Feeding on the General Metabolism, AM. JOUR. DIS. CHILD., 1912, **4**, 265.

is lowered during the first day following the fast, indicative of a replacement of the nitrogen lost during the endogenous metabolism of the fast. During the fast the chlorin excreted was very small in amount, and both indican and acetone were detected in the urine. The child also had an acetone breath.

Second Period, 6 p. m., July 12, to 6 p. m., July 22.—A period during which the food was changed several times in order to find a mixture suitable for the child. The child was not on the metabolism frame and no analytical data were secured during this period.

Third Period, 6 p. m., July 22, to 6 p. m., July 26.—The child had recovered from his intestinal trouble and was receiving the following formula: Fat, 1 per cent.; sugar, 6 per cent.; protein, 2 per cent.

10 per cent. cream	160 c.c.
Buttermilk	800 c.c.
Sterile water	640 c.c.
Milk-sugar	53 gm.

Seven feedings of 210 c.c. each every twenty-four hours. Approximately 637 calories or 145 calories per kilogram body weight.

As he seemed to be in good condition and gaining in weight on this food, he was placed on the metabolism frame at 6 p. m., July 22. During this period he continued to receive the food indicated above and the urine and feces were collected and examined in order to furnish data representing his normal nitrogen metabolism. During this period the body weight increased 165 gm., an average of 41.2 gm. per twenty-four hours. He was well in every respect.

Fourth Period, 6 p. m., July 26, to 6 p. m., July 29.—The child was not on the frame during this period but received the same food given in the preceding period. No macroscopic or microscopic evidence of fat, carbohydrate or protein indigestion was found.

Fifth Period, 6 p. m., July 29, to 6 p. m., August 7.—The child was again placed on the frame and the food received was made up according to the following formula: Fat, 1 per cent.; sugar, 6 per cent.; protein, 2 per cent.

10 per cent. cream	161 c.c.
Sterile water	1,439 c.c.
Lactose	89 gm.
Dry paracasein	25 gm.

Seven feedings of 210 c.c. each per twenty-four hours.

This mixture contained about the same amounts of fat, sugar and protein as the mixture given in the two preceding periods. The amount of protein ingested in twenty-four hours was less than in the case of the food made with buttermilk. This was due to the fact that it was almost impossible to manipulate the feeding-bottles so that all the paracasein was removed with the liquid portion of the food.

The inorganic salts were very much decreased in this mixture. In the preceding periods the mixtures fed contained the salts carried in the 160 c.c. of cream and the 800 c.c. of buttermilk. In the present case all the inorganic salts were derived from the 161 c.c. of 10 per cent. cream. The response to this decrease in the inorganic salt intake is shown in the lower figures obtained during this period for sodium chlorid, phosphates and acidity. The food contained 0.116 gm. of sodium chlorid per twenty-four-hour quantity while the amounts excreted dropped from 0.326 gm. the first day to nothing on the

eighth and ninth days, chlorin again appearing on the tenth day (the first day of the sixth period) even with a reduction in the chlorin intake on that day. This small chlorin excretion, zero for two days even, was not accompanied by any signs of physical discomfort.

During this period the body weight increased 120 gm., an average of 13.3 gm. per twenty-four hours.

Sixth Period, 6 p. m., August 7, to 6 p. m., August 14.—From 6 p. m., August 7, and during this period the food given to the child was made according to the following formula: Fat, 2 per cent.; sugar, 6 per cent.; protein, 2 per cent.

32 per cent. cream	54 c.c.
Sterile water	1,546 c.c.
Lactose	89 gm.
Dry paracasein	28 gm.

Seven feedings of 210 c.c. each per twenty-four hours.

This decreased the inorganic salts again and made the chlorin intake per twenty-four hours equal to 0.033 gm. of sodium chlorid, and the amounts excreted dropped from 0.148 gm. to 0 gm. on the fifth, sixth and seventh days. The child showed no particular discomfort as a result of this rather prolonged confinement on the metabolism frame, but on account of the loss of body weight it was thought best to discontinue the collection of urine and feces and remove the child from the frame at 6 p. m., August 14.

GENERAL DISCUSSION

In connection with the table which gives the result of our daily examination of the urines, we desire to call attention to the following points:

The acidity of the urines and the amounts of phosphates present decreased with the decrease in the amounts of whey ingested. This was to be expected as all the inorganic phosphates ingested were contained in the whey or cream used to make up the formulas. The amounts of organic phosphorus ingested were practically the same through all the periods.

The elimination of chlorin-free urine for two-day and three-day periods without symptoms of any nature is worthy of note.

A very marked increase in the ammonia output during the sixth period of the experiment is noticeable. During the fifth period the whey in the 161 c.c. of 10 per cent. cream furnished considerable neutral salts of organic acids (citrates, albuminates, etc.), the bases of which could be used to neutralize the acid bodies eliminated in the urine. During the sixth period, however, the intake of such base-carrying substances was much reduced, and sufficient bases were not ingested to neutralize the acid bodies eliminated in the urine. This resulted in an immediate increase in the amount of ammonia in the

TABLE 1.—Showing Change in Composition of Urine as a Result of Reducing the Intake of Inorganic Salts

Date*	Body Weight, Gm.	Urine											Average N. in Feces, Gm.
		Volume, C.c.	Specific Gravity	Total Acid, N/10, C.c.	P_2O_5, Gm.	Cl as NaCl, Gm.	Total N, Gm.	N as NH_3, Gm.	N as Urea, Gm.	Uric Acid, Gm.	Creatinin, Gm.	Creatin, Gm.	
7/10†‡	4,500	505	1.007	82.8	0.577	0.024	1.513	0.161	1.111	0.107	0.030	0.041	.....
1/11†‡	....	630	1.005	54.2	0.534	0.048	1.658	0.247	1.094	0.131	0.028	0.068	.....
7/12†	4,540	670	1.005	144.7	0.574	0.206	1.294	0.110	0.884	0.243	0.037	0.065	.....
7/12-22													
7/23	4,480	700	1.006	127.4	0.810	0.913	1.372	0.319	0.896	0.065	0.020	0.026	0.365
7/24	....	660	1.006	97.7	0.918	0.800	1.774	0.292	1.279	0.057	0.019	0.024	0.365
7/25	....	980	1.006	156.8	1.129	1.180	2.387	0.274	1.949	0.084	0.021	0.030	0.365
7/26	4,645	990	1.007	134.6	1.161	1.509	2.550	0.360	2.051	0.084	0.021	0.034	0.365
7/26-29													
7/30	4,730	1,200	1.004	98.4	0.760	0.326	1.747	0.175	....	0.053	0.022	0.020	0.173
7/31	....	1,220	1.003	41.5	0.386	0.332	1.264	0.164	0.929	0.078	0.022	0.030	0.173
8/ 1	....	1,300	1.002	41.6	0.398	0.140	1.092	0.175	0.845	0.053	0.023	0.020	0.173
8/ 2	....	1,240	1.002	39.7	0.379	0.298	1.146	0.208	0.724	0.066	0.021	0.025	0.173
8/ 3	....	1,070	1.003	42.8	0.317	0.223	1.079	0.216	0.713	0.057	0.019	0.022	.....
8/ 4	....	670	1.003	24.1	0.233	0.115	0.925	0.173	0.522	0.045	0.018	0.021	.....
8/ 5	....	1.170	1.003	56.2	0.370	0.047	1.409	0.216	0.963	0.081	0.020	0.028	.....
8/ 6	....	1.060	1.003	33.9	0.357	0.000	1.676	0.261	....	0.072	0.020	0.029	.....
8/ 7	4,850	1.060	1.003	33.9	0.357	0.000	1.676	0.261	....	0.072	0.020	0.029	.....
8/ 8	....	1.060	1.002	38.2	0.232	0.148	1.039	0.522	0.284	0.072	0.020	0.027	.....
8/ 9	....	850	1.003	47.6	0.390	0.065	1.275	0.509	....	0.084	0.020	0.015	.....
8/10	....	970	1.003	26.6	0.317	0.067	1.249	0.494	....	0.082	0.022	0.019	.....
8/11	....	1,060	1.003	27.6	0.378	0.015	1.276	0.392	0.613	0.086	0.020	0.020	.....
8/12	....	1,000	1.003	32.0	0.275	0.000	1.036	0.476	....	0.087	0.017	0.015	.....
8/13	....	900	1.005	28.8	0.303	0.000	1.411	0.731	....	0.075	0.017	0.019	.....
8/14	4,510	760	1.003	33.4	0.357	0.000	1.105	0.655	0.378	0.092	0.020	0.017	.....

* Twenty-four-hour period ending 6 p. m. † Traces of indican appeared in the urine on these days. ‡ Traces of acetone on these days.

urine with a corresponding decrease in the urea. For the twenty-four hours ending at 6 p. m., August 7, the urine contained 0.261 gm. of nitrogen present as ammonia, and for the twenty-four-hour period ending at 6 p. m., August 8, the first day of the reduction of the intake of the salts to the lowest figure, the urine contained 0.522 gm. of nitrogen in the form of ammonia, an increase of 100 per cent. in one day.

It will be noticed that only a small part of the ammonia is necessary to neutralize the phosphates. Just what the nature of the acid bodies is we are not able to state. We did not detect the presence of acetone bodies in the urine at any time during this period.

The amounts of creatinin and creatin excreted during the fasting period were much above the normal as would be expected. During the other three periods the creatinin figures are strikingly uniform.

During the third period, when the food contained an excess of all constituents, the child increased in body weight an average of 41.2 gm. per twenty-four hours and the creatin output averaged 0.028 gm. per day. In the fifth period when the whey had been reduced to the amount carried in 161 c.c. of 10 per cent. cream, the average daily increase in body weight was reduced to 13.3 gm. and the average daily creatin excretion was 0.025 gm. In the sixth period there was an average daily decrease in body weight of 48.6 gm., and the average daily excretion of creatin was 0.015 gm. with a daily fluctuation giving figures between 0.027 and 0.015 gm.

No symptoms of any nature developed during the fifth and sixth periods.

II. THE REDUCTION OF THE INTAKE OF INORGANIC SALTS TO A POINT AT WHICH A CONTINUOUS EXCRETION OF CHLORIN-FREE AND PHOSPHORUS-FREE URINE IS PRODUCED

We have shown in a previous paper how the feeding of an excessive amount of calcium may result in the precipitation within the intestines of all the ingested phosphorus as insoluble calcium phosphate and thus reduce the phosphorus metabolism to such a low level that the urine becomes phosphorus-free and contains a large amount of carbon dioxid.[3]

We have been able to take advantage of this fact and, by the feeding of a synthetic food containing no inorganic salts but considerable

3. Bowditch, H. I., and Bosworth, A. W.: Boston Med. and Surg. Jour., 1917, **177**, 864.

soluble calcium, we have reduced the chlorin intake and output to nil and brought about the excretion of a phosphorus-free urine.

This investigation began when the child was placed on the metabolism frame, July 13, 1915, and may be divided into two periods.

First Period, 9 a. m., July 13, to 9 a. m., July 14.—During this first twenty-four hours the child received 1,260 c.c. of a modified milk containing 2 per cent. of fat, 6 per cent. of lactose and 2 per cent. of protein.

Second Period, 9 a. m., July 14, to 9 a. m., July 22.—During the next eight days the child received a chlorin-free synthetic[4] milk containing pure butter fat, 2 per cent.; lactose, 6 per cent.; sodium caseinate, 2 per cent., and calcium acetate [$(CH_3COO)_2Ca.H_2O$)] 0.167 per cent. The only phosphorus present in this food was that contained within the casein molecule. The child received 1,260 c.c. of this food every twenty-four hours.

The data secured will be found in Table 2. By consulting the table it will be noticed that the urine became alkaline on the first day of the second period and remained so while the child received the synthetic milk. All the urines during this period were heavily charged with carbon dioxid, the addition of a drop of hydrochloric acid causing a marked effervescence.

The urine became chlorin-free on the first day of the second period and phosphorus-free on the fourth day. A marked increase in the ammonia excretion is noticed during the time the child received the food containing no milk salts. Most of the phosphoric acid resulting from the digestion of the casein was precipitated in the intestines as insoluble calcium phosphate and appeared as such in the feces. The remainder must have been assimilated and retained, for the urine soon became phosphorus-free.

No symptoms of any kind developed during this experiment.

III. THE REDUCTION OF THE INTAKE OF INORGANIC SALTS TO A POINT WHERE A CONTINUED EXCRETION OF CHLORIN-FREE URINE IS PRODUCED ACCOMPANIED BY THE INGESTION OF LARGE AMOUNTS OF SODIUM CASEINATE

The child selected for this experiment was 11 months old, weighed 7,129 gm., and seemed to be in good physical condition. He was placed on the metabolism frame at 9:30 a. m., July 26. The investigation may be divided into two periods.

4. Bowditch, H. I., and Bosworth, A. W.: Studies of Infant Feeding, Tr. Am. Ped. Soc., 1916, **28**, 114.

TABLE 2.—Showing Change in Composition of Urine as a Result of Reducing the Intake of Inorganic Salts to a Point which Results in the Excretion of a Chlorin- and Phosphorus-Free Urine

24-Hour Period Ending. 1915	Body Weight, Gm.	Urine									Feces			
		Volume, C.c.	Specific Gravity	Total Acidity as C.c. of N/10	P_2O_5, Gm.	Chlorin, Gm.	Total N, Gm.	N as NH_3, Gm.	Calcium Oxid, Gm.	Lactic Acid, Gm.	Dry Weight, Gm.	Fat, Gm.	Calcium Oxid, Gm.	Phosphoric Oxid, Gm.
8/14	5,336	510	1.009	113.2	0.816	0.707	1.948	0.251	0.057	None	12.15	5.01	0.937	0.363
8/15	....	260	1.014	Alk.	0.286	None	1.877	0.497	0.058	None	7.67	3.03	0.571	0.186
8/16	....	530	1.008	Alk.	0.133	None	1.677	0.502	0.062	None	7.06	1.88	0.660	0.131
8/17	....	410	1.009	Alk.	0.082	None	1.484	0.786	0.048	None	7.47	3.07	0.573	0.126
8/18	....	300	1.012	Alk.	0.054	None	1.490	0.572	0.045	None	9.28	3.04	0.904	0.213
8/19	....	300	1.011	Alk.	None	None	1.374	0.539	0.030	None	3.58	0.87	0.243	0.084
8/20	....	240	1.010	Alk.	None	None	1.291	0.304	0.040	None	6.68	2.55	0.565	0.175
8/21	....	480	1.007	Alk	None	None	1.032	0.454	0.046	None	6.50	2.41	0.612	0.150
8/22	4,768	420	1.006	Alk	None	None	0.997	0.316	0.041	None	5.27	2.46	0.457	0.128

TABLE 3.—Showing Change in Composition of Urine as a Result of Reducing the Intake of Inorganic Salts and Feeding Large Amounts of Sodium Caseinate

24-Hour Period Ending	Body Weight, Gm.	Urine											
		Volume, C.c.	Specific Gravity	Total Acidity as C.c. of N/10	Chlorin, Gm.	Phosphoric Oxid, Gm.	Total N, Gm.	N as NH_3, Gm.	Uric Acid, Gm.	Creatinin, Gm.	Creatin, Gm	Calcium Oxid, Gm.	Lactic Acid, Gm.
7/27	7,129	640	1.008	83.2	0.672	0.826	2.87	0.39	0.147	0.078	0.089	0.029	None
7/28	....	760	1.010	Alk.	0.399	0.456	4.36	0.85	0.120	0.074	0.075	0.056	None
7/29	....	780	1.011	Alk.	0.137	0.741	5.13	2.88	0.110	0.078	0.020	0.055	None
7/30	....	830	1.011	Alk.	0.145	0.315	6.51	0.49	0.089	0.073	0.050	0.076	None
7/31	....	810	1.011	Alk.	0.062	0.194	5.90	0.41	0.092	0.071	0.050	0.060	None
8 /1	....	840	1.013	Alk.	0.047	0.378	6.88	0.85	0.120	0.080	0.065	0.077	None
8/ 2	....	840	1.010	Alk.	0.082	0.294	8.47	0.85	0.073	0.074	0.074	0.097	None
8/ 3	....	1,020	1.010	Alk.	0.092	0.306	7.14	1.26	0.119	0.077	0.072	0.135	None
8/ 4	....	840	1.010	Alk.	0.000	0.327	8.88	2.42	0.092	0.069	0.060	0.068	None
8/ 5	....	760	1.013	Alk.	0.000	0.800	7.02	3.02	0.076	0.066	0.048	0.041	None
8/ 6	....	570	1.013	Alk.	0.000	0.500	8.06	3.17	0.084	0.072	0.050	0.031	None
8/ 7	7,013	680	1.011	Alk.	0.000	0.200	8.85	2.53	0.107	0.081	0.070	0.064	None

First Period, July 26, to July 27.—During the first twenty-four hours the child received a food made up as follows:

Whole milk	75 c.c.
Dextri-maltose to make total sugar	5%
Boiled water to make	100 c.c.

Five feedings, 227 c.c. each.

This food contained fat, 3 per cent.; sugar, 5 per cent., and protein 2.4 per cent.

Second Period, July 27 to August 7.—At 9:30 a. m., July 27, the food was changed to a synthetic milk containing fat, 2 per cent.; sugar, 6 per cent., and sodium caseinate, 6.5 per cent. He received five feedings of 227 c.c. each per day. The feces was so small in amount that no work was done on it. (In this connection see a previous paper by us.[5])

The data secured will be found in Table 3. Here we again have an alkaline urine containing large amounts of carbonate and ammonia. The uric acid, creatinin and creatin outputs show no marked variations from day to day. No symptoms of any nature developed.

IV. THE REDUCTION OF THE INTAKE OF INORGANIC SALTS TO A POINT AT WHICH CHLORIN-FREE URINE IS EXCRETED, ACCOMPANIED BY THE INGESTION OF LARGE AMOUNTS OF CALCIUM CASEINATE

The child selected was 10 months old, weighed 5,477 gm., and seemed to be in good physical condition. He was placed on the metabolism frame at 8 p. m., July 11. The investigation may be divided into two periods.

First Period, July 11 to July 12.—During the first twenty-four hours the child received a food made up as follows:

Fat-free milk	75 c.c.
Dextri-maltose	5 gm.
Boiled water to make	100 c.c.

Six feedings, 170 c.c. each.

This food contained fat, a trace; sugar, 8 per cent., and protein 2.4 per cent.

Second Period, July 12 to July 18.—At 8 p. m., July 12, the food was changed to one made according to the following formula:

32 per cent. cream	65 c.c.
20 per cent. lactose solution	377 c.c.
Calcium caseinate	87 gm.
Sodium citrate	80 grains
Water to make	1,392 c.c.

Six feedings, 170 c.c. each.

This food contained fat, 1.50 per cent.; sugar, 5.63 per cent.; protein, 6.25 per cent., and calcium oxid, 0.1575 per cent. The data secured during this experiment will be found in Table 4 and Chart 1. The food used for this investigation had a low chlorin and high calcium content.

5. Bowditch, H. I., and Bosworth, A. W.: Boston Med. and Surg. Jour., 1917, **177**, 864.

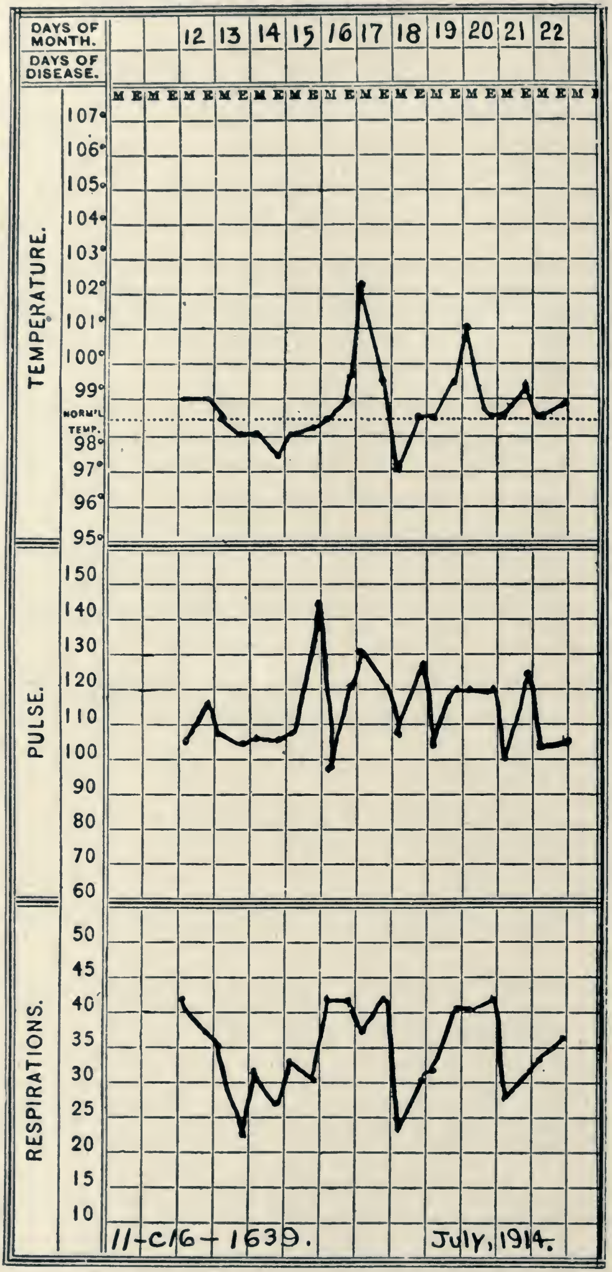

Chart 1.—Record of the temperature, pulse and respiration as observed in connection with the tests outlined in Table 4.

The most striking point brought out by the data in Table 4 is the appearance of lactic acid in the urine on the 15th, followed by a toxic condition which manifested itself during the night of the 16th. The appearance of the lactic acid is accompanied by a greatly increased elimination of calcium. It will be noticed that the temperature of 102.4 F. recorded on the morning of the 17th is reduced during the day and seemed to be directly associated with the ingestion of the early morning feeding. Possibly the lactose in the food had some influence in reducing the temperature.

The lactic acid was determined by extracting the acidulated urine with ether, distilling off the ether, dissolving the residue in water, evaporating to a thick syrup, taking up with water, converting the lactic acid to the zinc salt by the addition of zinc oxid, boiling, filtering, evaporating the filtrate to dryness, drying in the oven for two hours and weighing. The weights were checked by burning the zinc lactate and weighing the residual zinc oxid. The lactic acid was identified by the crystals of zinc lactate.

Owing to the uncomfortable condition of the child, he was removed from the metabolism frame on the 18th, but continued to receive the same food until the morning of the 21st. During the night of the 19th another temperature was noticed which also seemed to be lowered by the ingestion of food.

The greatly increased elimination of uric acid, creatinin and creatin during this experiment is to be expected as a result of the fever. It is worthy of note that none of the urines in this set showed the presence of carbonates.

The toxic condition produced during this experiment we believe to be due to the following circumstances. The digestion of fat and protein within the intestine results in the production of acids, fatty acids from fat and amino-acids or polypeptic acids from the proteins. These acids do not remain as free acids but immediately unite with the bases present in the intestines to form salts, the soluble salts being absorbed, the insoluble salts being eliminated in the feces. In the presence of the large amount of calcium carried into the intestines in combination with the casein many more of these acids form calcium salts than would be the condition under more normal circumstances. The soluble organic salts are carried to the tissues and the organic part used for vital activities leaving as refuse the base calcium which has acted

TABLE 4.—Showing Change in Composition of Urine as a Result of Reducing the Intake of Inorganic Salts and Feeding Large Amounts of Calcium Caseinate

24-Hour Period Ending at 8 p. m., 1914	Urine												Feces			
	Volume, C.c.	Specific Gravity	Total Acidity as C.c. of N/10	Chlorin, Gm.	P_2O_5, Gm.	Total Nitrogen, Gm.	Nitrogen, as Ammonia, Gm.	Uric Acid, Gm.	Creatinin, Gm.	Creatin, Gm.	Calcium Oxid, Gm.	Lactic Acid, Gm.	Dry Weight, Gm.	Total N, Gm.	P_2O_5, Gm.	Calcium Oxid, Gm.
7/12	660	1.010	59.4	0.809	0.53	3.53	0.340	0.145	0.086	0.034	0.0462	0.0000	10.1	0.606	0.170	1.075
7/13	720	1.009	13.0	0.655	0.36	4.29	0.363	0.092	0.060	0.049	0.0432	0.0000	9.1	0.528	0.122	0.901
7/14	750	1.010	123.0*	0.394	0.34	4.83	0.522	0.085	0.072	0.023	0.0825	0.0000	9.0	0.653	0.109	0.603
7/15	626	1.011	82.2*	0.031	0.95	4.62	1.403	0.186	0.097	0.052	0.1640	0.2799	13.0	0.868	0.222	0.902
7/16	680	1.013	21.8*	0.000	0.20	5.21	0.823	0.336	0.113	0.127	0.1537	0.5208	14.0	0.963	0.252	1.244
7/17	650	1.016	27.3	0.073	0.31	6.64	0.454	0.325	0.100	0.100	0.1274	0.3608	14.5	0.931	0.246	0.940
7/18	730	1.015	2.9	0.000	0.22	6.95	1.083	0.380	0.123	0.083	0.2015	0.9075	....	....	....	....

* Alkalinity.

TABLE 5.—Showing Composition of the Urine when Large Amounts of Calcium Caseinate Is Ingested Accompanied by Large Amounts of Inorganic Salts (Whey)

24-Hour Period Ending at 8 p. m., 1914	Volume, C.c.	Specific Gravity	Total Acidity as C.c. of N/10	Chlorin, Gm.	P_2O_5, Gm.	Total Nitrogen, Gm.	Nitrogen as Ammonia, Gm.	Uric Acid, Gm.	Creatinin, Gm.	Creatin, Gm.	Calcium Oxid, Gm.	Lactic Acid, Gm.
7/12	600	1.010	30.0	0.714	0.68	2.50	0.285	0.107	0.071	0.042	0.0132	0
7/13	620	1.010	20.0*	0.608	0.59	2.97	0.576	0.099	0.071	0.045	0.0372	0
7/14	580	1.013	93.0*	0.304	0.33	4.93	0.601	0.085	0.070	0.054	0.0152	0
7/15	670	1.014	60.0*	0.304	0.37	5.07	0.657	0.107	0.070	0.065	0.0938	0
7/16	740	1.013	59.0*	0.622	0.31	8.88	0.315	0.096	0.072	0.073	0.1154	0
7/17	670	1.014	36.0*	0.539	0.35	8.85	0.555	0.103	0.074	0.052	0.1072	0
7/18	730	1.015	48.0*	1.613	0.45	8.47	0.220	0.100	0.073	0.050	0.0847	0

* Alkalinity.

simply as a conveyor and neutralizer. Under normal conditions this calcium would form chlorid or phosphate and be eliminated in the urine immediately. Under the conditions of this experiment there was no chlorin available for such purpose and very little phosphorus. The result is an accumulation of calcium until a toxic condition is reached and then, during the fever, an abundant elimination of soluble calcium lactate.

V. THE FEEDING OF LARGE AMOUNTS OF CALCIUM CASEINATE WHEN ACCOMPANIED BY THE INGESTION OF LARGE AMOUNTS OF INORGANIC SALTS (WHEY)

The child selected was 5 months old, weighed 5,371 gm., and seemed to be in good physical condition. He was placed on the metabolism frame at 8 p. m., July 11. The investigation may be divided into two periods.

First Period, July 11 to July 12.—During the first twenty-four hours the child received a food made up as follows:

Whole milk	60 c.c.
Boiled water	40 c.c.
Maltose to make sugar	6%

Six feedings, 170 c.c. each.

This food contained, fat, 2.4 per cent.; sugar, 6 per cent., and protein 1.9 per cent.

Second Period, July 12 to July 18.—At 8 p. m., July 12, the food was changed to one made according to the following formula:

32 per cent. cream	65 c.c.
20 per cent. lactose solution	331 c.c.
Calcium caseinate	87 gm.
Sodium citrate	80 grains
Whey	580 c.c.
Water to make	1,392 c.c.

Six feedings, 170 c.c. each.

This food contained, fat, 1.50 per cent.; sugar, 6.4 per cent., and calcium oxid, 0.1575 per cent.

The data secured will be found in Table 5. In this case sufficient chlorin and phosphorus had been ingested to permit the elimination of all the calcium as soluble chlorid or phosphate, and our data shows nothing worthy of note, the ingestion of the large amount of calcium causing no upset in the condition of the child.

CONCLUSIONS

We have shown that the ingestion of large amounts of calcium and the absorption of this calcium as organic salts, if not accompanied by the ingestion of sufficient chlorin or phosphorus to permit of the formation of soluble salts will result in an accumulation of calcium in the tissues which is followed by a toxic condition and the elimination of calcium lactate in the urine.

The toxic condition noticed by others when a high protein synthetic food was fed was probably the result of the high calcium content of the food, as our work reported in this and previous papers seems to indicate, and not the result of the high protein content, the protein being responsible only to the extent that it is the carrier of the calcium in the form of calcium caseinate.

Whether the toxic condition noticed is the result of the accumulated calcium itself or to a calcium salt, possibly calcium oxalate, we are not prepared to state.

C. Bruger[6] has recorded the fact that the injection of neutral or alkaline phosphates of sodium resulted in a diminution in the calcium content of the serum and a condition of tetany. In view of the fact that the overloading of the serum with neutral or alkaline phosphates would favor the precipitation of calcium salts we are inclined to believe our results and his to be manifestations of the same phenomenon.

We also believe the observations of Marriott and Howland,[7] in which they noticed a diminution in the calcium content of the serum and a marked phosphorus retention, to have some bearing on the same phenomenon.

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6. Bruger, C.: Toxicity of Phosphates in Relation to Blood Calcium and Tetany, Jour. Pharmacol., 1917, **10,** 105.

7. Marriott, W. McK., and Howland, John: Phosphate Retention as a Factor in the Production of Acidosis in Nephritis, Arch. Int. Med., 1916, **18,** 108.

UNUSUAL HYPERPYREXIA IN PNEUMONIA, WITH RECOVERY

REPORT OF TWO CASES IN CHILDREN OF 2½ AND 5¼ YEARS, RESPECTIVELY *

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Terminal hyperpyrexia is unfortunately not at all an infrequent ending of various affections. It may take place in any of the infectious diseases, and is, of course, a well-known incident in thermic fever. I have known it to reach 110 F. in children during excessively hot weather, the symptoms being digestive, but only slightly marked, and the fatal termination being attributable to the direct influence of the heat of the air. It is true that children bear hyperpyrexia, if not excessive, sometimes surprisingly well. I recall one instance of typhoid fever, with a temperature during several days continuously not lower than 105 and 106, and on several occasions 107 F., yet with no unfavorable symptoms whatever, the little girl of 10 years lying comfortable and smiling in her bed. Temperature above this degree, with subsequent recovery, is, however, in my experience very uncommon, and the two following cases with their temperature charts may therefore be not without interest.

Case 1.—The first case, seen in consultation with Dr. Myer Solis-Cohen, was observed in a girl baby 2½ years of age. The course in most respects was that of a typical bronchopneumonia, with increasing, and finally, rather extensive consolidation involving parts of both lungs in scattered areas. The total duration was about two weeks. Throughout the attack there was considerable cyanosis, at times restlessness, and occasionally profuse sweating. Although the patient was evidently severely ill, the heart sounds throughout remained fairly good, the patient never appeared to be in any immediate danger, and a guardedly favorable prognosis was given at all times. The most interesting feature was the continued tendency to high fever, with a daily maximum of 104 to 107, and on one occasion 108 F., with rapid drops to 100 or 101. The course of the fever is shown in the accompanying chart (Fig. 1).

Case 2.—The second case, seen in consultation with Dr. E. J. Lupin, was even more interesting. It well illustrates the danger of giving a favorable prognosis for any individual case, basing this upon the general experience with the disease; and, on the other hand, of prognosticating unfavorably even

* Read by title.

in the presence of most alarming symptoms. The case was at first an ordinary typical one of croupous pneumonia in a boy of 5¼ years. Realizing that the disease at this age nearly always terminates in recovery, the parents were told that it was progressing in an entirely normal manner, and that there was no cause for anxiety. The temperature had been not unduly elevated, the mind

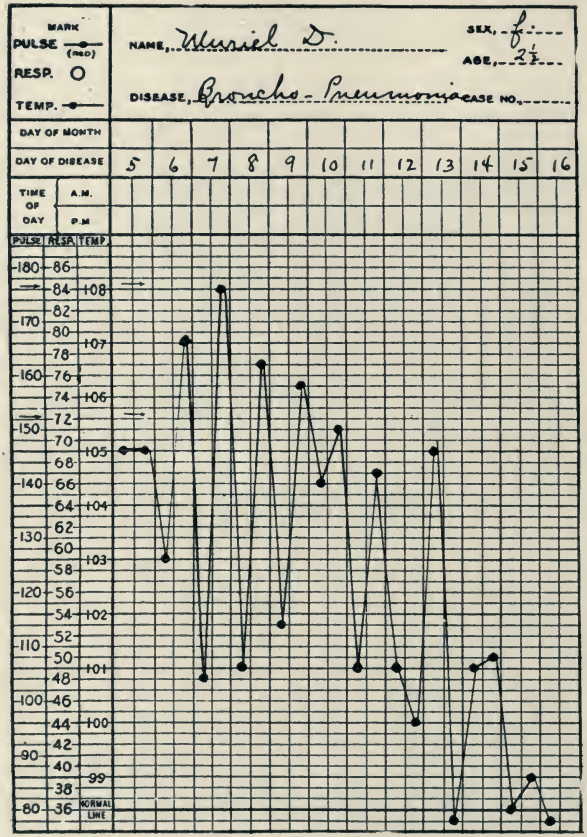

Fig. 1.—Temperature chart in Case 1.

was entirely clear, the cardiac strength excellent. This favorable condition continued until the seventh day of the attack, when an unusual degree of drowsiness developed, and the temperature became higher. On the tenth day of the attack, instead of the convalescence which we had fully expected even before this date, the temperature began to rise, the pulse grew very weak, and the child appeared to be rapidly sinking. Dr. Lupin and myself were summoned hurriedly about 8 p. m., and found two other physicians, called in the emergency, already present. The fever had risen to 109 F., as recorded by

two different thermometers. A warm mustard bath had been given, and the temperature had fallen to 106, yet with the pulse still rapid and no improvement in the general condition of the child, who was unconscious and evidently extremely ill. We looked at each other with solemnly shaking heads, and the whispered words "terminal hyperpyrexia, hopeless," and the like. In twelve

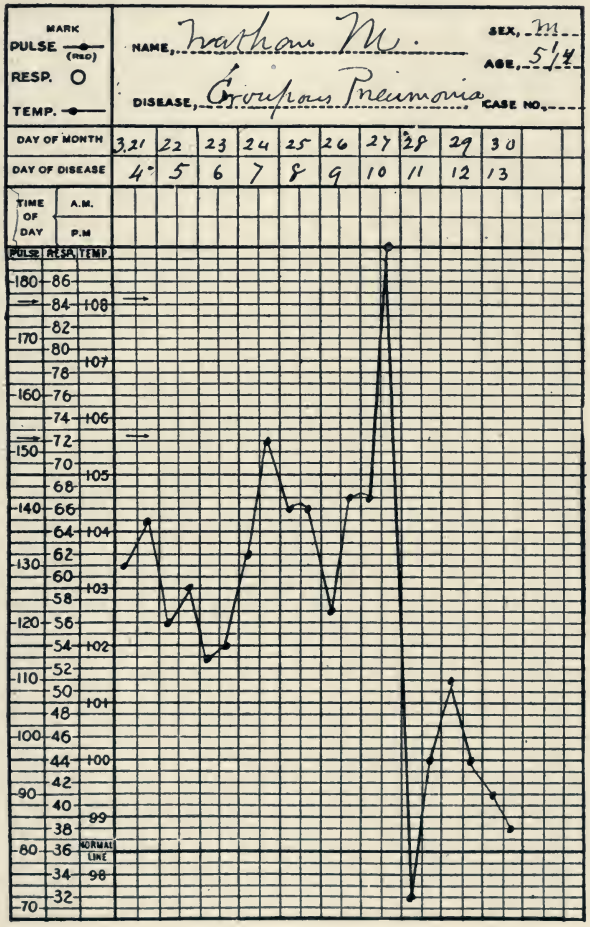

Fig. 2.—Temperature chart in Case 2.

hours, however, the temperature had dropped nearly 12 degrees, as shown by the chart (Fig. 2), and the general condition, although still very bad, was better. Then followed a slight extension of the pneumonic process, with return of fever of moderate degree; great restlessness; delirium, and sleepless-

ness which yielded to neither bromids nor morphin. By the thirteenth day of the disease the child was weak and listless, but with mind entirely clear, and convalescence appeared established. There was no further return of fever.

Cases of this nature are certainly most unusual, and fortunately so. I recall an instance reported by Couch[1] of recovery in a case of croupous pneumonia in a child of 3 years, after a temperature of 109 F. had been attained; but no other has come to my notice, although doubtless a search through medical literature would reveal other instances.

1. Brit. Med. Jour. **2**:1212, 1896.

A POCKET-CARD FOR THE EASY CALCULATION OF MILK-MIXTURES

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The evident need of a simplification of the procedures required for the prescribing of milk-formulas of known strengths in infant feeding has led to the devising of numerous ready methods. One which, emanating from Germany, has had a decided vogue in parts of this country during the last few years has been denominated the method of the "simple dilution" of whole milk. It probably owes its origin to Heubner, and has much in its favor. It should be at once understood, however, that, contrary to a widespread opinion, it in no sense does away with the calculation of percentages, since it was intended to be employed in conjunction with the estimation of the caloric value of the milk-mixture used; and this, of course, cannot be done unless the percentage composition of the food is known. In fact, it is an impossibility to prepare a milk-formula in a way which offers the best chance of its agreeing with the infant, without a knowledge of the action on the economy of the several different ingredients of the milk, and a recognition of the quantity of fat, sugar and protein which the food contains. The all too frequent attempt encountered in many quarters to use "simple dilutions" without this knowledge is a retrogression to the ignorance under which the physicians of fifty years ago were obliged to labor.

It is further to be observed that the confining of ourselves to simple dilutions of whole milk, while suitable for the feeding of many infants with disturbed digestion, deprives the healthy infants of the amount of fat which they are capable of digesting and ought to have, while on the other hand it maintains an inevitable fixed ratio of fat to protein, which is by no means always desirable. The dilution method is simple and admirable; but we can extend greatly the range of our possible choice of mixtures by using dilutions of certain of the layers of milk; in some cases whole milk; in others milk with a portion of the lower part of the jar removed; in others with a part of the cream layer removed. The process of prescribing the formula, as well as of

the preparation of the food, is as easy by one method as by either of the others. These facts are, of course, well understood, but seem prone to be forgotten or ignored by those whose mental vision is concentrated on some single favorite feeding method.

With the object in view of making the preparation of the infant's food as comprehensible and as simple as possible for students, I have for years followed in teaching the procedures now to be described. Recently I have had prepared a printed pocket-card for distribution to the members of my class; and it is a description of the method of using this card which is my object here.

Table Giving Approximate Percentage-Strengths of Different Layers of Milk

	Per cent. Fat	Per cent. Protein and Sugar	Ratio
Upper 2 oz.	24	4	6 to 1
" 4 "	20	4	5 to 1
" 6 "	16	4	4 to 1
" 8 "	12	4	3 to 1
" 10 "	10	4	2.5 to 1
" 16 "	8	4	2 to 1
" 20 "	6	4	1.5 to 1
" 24 "	5	4	1.25 to 1
" 32 "	whole milk	4	1 to 1
Lower 30 "	3	4	.75 to 1
" 28 "	2	4	.50 to 1
" 16 "	1	4	.25 to 1
" 8 "	0.5	4	0 to 1

To Find the Amount of Any Layer of Milk to be Used to Give Percentages Desired

Equation:

$$\frac{\text{Total amount of food} \times \text{Percentage of fat desired}}{\text{Fat-strength of layer of milk used}} = \text{Amount of this milk in the mixture.}$$

(1) Select from the "Layers of Milk" Table the milk which possesses the desired ratio of fat to protein.
(2) Substitute in the equation.
(3) As the sugar-percentage has been reduced equally with that of the protein, add sufficient sugar to raise to the desired percentage.

EXAMPLE: 20-oz. mixture desired. Percentages desired = Fat 3, Sugar 6, Protein 1. Use upper 8 oz. (fat 12%, protein 4%, viz: 3 : 1). Then $\frac{20\times3}{12}=5$ oz. of upper 8 oz., with 15 oz. of water in the 20-oz. mixture. The protein necessarily becomes 1%, and the sugar likewise. The mixture already containing 1% of sugar, add 5% of 20 oz., i. e., 1 oz. of sugar to increase this to the 6% desired.

To Determine the Percentages Present in Any Milk-Mixture Already in Use

$$\frac{\text{Quantity of substance used (milk, cream, or skimmed milk)} \times \text{Its percentage-strength}}{\text{Total Quantity of Food}} = \text{Percentage of element (F., S. or P.) in the mixture.}$$

EXAMPLE: The mother has mixed: Upper 8 oz.; 6 oz.—Lower 8 oz.; 3 oz.—Milk-sugar 3 level tablespoonfuls.—Water 27 oz. Total quantity = 36 oz. The upper 8 oz. contains 12% fat (see Table). Both top and bottom milk contain 4% protein and sugar. Three tablespoonfuls sugar = approximately 1 oz. The fat of the lower 8 oz. may be ignored. Then $\frac{6\times12}{36}=3$ = Fat percentage from the top-milk. $\frac{3\times0}{36}=0$ = Fat-percentage from the bottom milk. $\frac{9\times4}{36}=1$ = Protein and sugar percentages from combined top and bottom milk. The 1 oz. additional sugar divided by 36 = approximately 3% sugar added. There being already 1% sugar derived from the milk, the total sugar = 4%.

Fig. 1.—Front of card.

Placed to the left on the front of the card (Fig. 1) is a table of the percentage strengths of fat, sugar and protein of different layers of the quart of milk. The figures given are based on published investigations by a number of writers, as well as on a large number of new analyses made at my request. They may fairly be considered average ones. The table is not entirely accurate, and is not, indeed, intended to be. It is necessary only that it be approximate, since it is not so much initial accuracy which is required as the ability readily to increase or decrease the various percentages as necessity demands. For instance, the actual protein content of whole milk is nearer 3.5 or 3.6 per cent. than it is 4 per cent. The sugar percentage should be

4.5 instead of 4. It long ago impressed me, however, that a slight distortion of the figures would result in the production of certain gradually changing ratios of the fat, on the one hand, to the sugar and protein on the other, which would lighten greatly the labor of any calculating required. In what a simple sequence the ratios run, how easily remembered they are, and what a range of choice they present is shown by an inspection of the table. The error resulting from the intentional distortion referred to is insignificant. For instance, in a mixture containing, according to the table, 2 per cent. of fat and 1 per cent. of protein, the actual protein percentage is nearer 0.9 per cent.,

Ready Method for Selecting
Amounts to be Employed in Making Various 20-Oz. Milk-Mixtures, and the Caloric Values Resulting

Percentages desired of			Lower 8 oz.	Lower 16 oz.	Lower 28 oz.	Whole Milk	Upper 24 oz.	Upper 20 oz.	Upper 16 oz.	Upper 10 oz.	Upper 8 oz.	Water oz.	Sugar oz.	Caloric Value of Mixture	Calories per oz.
Fat	Sugar	Prot'n													
0.5	5	1	..	..	5	..	..	..	..	..	..	15	0.8	175	8.75
0.5	6	2	..	10	..	..	..	..	..	..	..	10	0.8	225	11.25
1	6	1	..	..	..	5	..	..	..	..	..	15	1	225	11.25
1	6	1.5	2.5	..	..	5	..	..	..	..	..	12.5	0.9	237.5	11.88
1	6	2	..	..	10	..	..	..	..	..	..	10	0.8	250	12.5
1.5	6	1	..	..	..	..	..	5	..	..	..	15	1	250	12.5
1.5	6	1.5	..	..	..	7.5	..	..	..	..	..	12.5	0.9	262.5	13.13
2	6	1.5	2.5	..	..	..	..	..	5	..	..	12.5	0.9	287.5	14.38
2	6	2	..	..	..	10	..	..	..	..	..	10	0.8	300	15
2.5	6	1.5	2.5	..	..	..	..	..	..	.5	..	12.5	0.9	312.5	15.63
2.5	6	2	..	..	..	..	10	..	..	..	..	10	0.8	325	16.25
2.5	6	2.5	..	..	..	12.5	..	..	..	..	..	7.5	0.7	337.5	16.88
3	6	1	..	..	..	..	..	..	..	..	5	15	1	325	16.25
3	6	1.5	2.5	..	..	..	..	..	..	..	5	12.5	0.9	337.5	16.88
3	6	2	..	..	..	..	..	10	..	..	..	10	0.8	350	17.5
3	6	3	..	..	..	15	..	..	..	..	..	5	0.4	375	18.75
4	4	4				20		..	..			0	..	400	20

Fig. 2.—Back of card.

and that of sugar 1.12 per cent. — differences which are entirely negligible. It is only when mixtures containing high percentages of protein are employed that the error becomes greater; and then, even with a calculated 3 per cent. protein, it is still less than 0.5 per cent. So, too, the fatter layers of milk, such as those containing 16 or 24 per cent. of fat, possess somewhat less protein than is present in whole milk; but so little of these is usually added to the mixture that the error is entirely trivial. Finally, no allowance is made for the small amount of fat in the lower layers of milk; but this, too, becomes negligible in practice. A short inspection of the table shows how easy it is of application. Thus a milk-formula containing fat, 2 per cent.,

and protein, 2 per cent., is made by mixing equal parts of whole milk and water, since the ratio of the fat to the protein is 1 : 1. A formula calling for fat, 3 per cent., and protein, 2 per cent., is constructed by mixing equal parts of water and of the upper 20 ounces of the quart, with a ratio, according to the table, of 1½ : 1. A low fat formula, such as one containing fat, 1 per cent., and protein, 2 per cent., is made by diluting a portion of the lower 28 ounces of the quart with an equal amount of water. When fat-free milk is desired, the lower 8 ounces can be used, which contain so small a percentage of fat that, especially when diluted, it can be regarded for practical purposes as fat free.

For some individuals it is more convenient to be able to construct a milk-mixture by means of an equation, and by these the directions on the upper right-hand portion of the card can be used. One great advantage is to be pointed out here, namely, that only one calculation is required for both the fat and the protein, since after we have once selected the percentages of these desired, and chosen the layer of milk which possesses the ratio which these figures represent, as seen in the table, the calculation which gives us the fat necessarily gives us the protein also. Further, that the percentages of protein and sugar obtained by the calculation are the same; that is, if the food has 1 per cent. of protein it has also 1 per cent. of sugar, and the addition of the extra amount of sugar needed is easy.

At the bedside the mother tells us the composition of the infant's food in use in the gross quantities employed by her of milk, cream, sugar, water and the like; and it is necessary in our attempt to discover the faults present that we should be able easily to determine the strength of the mixture in fat, sugar and protein, respectively. The method detailed on the lower portion of the card enables us to do this very readily and quickly.

There are students, however — and practitioners, too — to whom any calculation of the simplest sort is a burden. For the benefit of these I have prepared the table printed on the reverse side of the card (Fig. 2). This enables one at a glance to prescribe practically any percentages likely to be used in which nothing but milk, water and sugar are employed. In the columns to the right of this table are given the caloric values of the 20 ounce mixture, on which, as a matter of convenience, all the calculations are based, as well as the caloric value of each fluidounce of the formula.

In the employment of weak cereal decoctions as diluents, it is customary to ignore the carbohydrate content present. Those who desire to use a cereal water as a diluent and to calculate the amount of carbohydrate derived from this may do so readily by making a decoction of, say, 1 per cent. strength in carbohydrate (about 1 level tablespoonful of barley flour to the pint); adding the percentage of carbohydrate derived from the amount of this used to that coming from the sugar in the milk, and then finally adding sufficient sugar to the mixture to bring the total up to the desired carbohydrate percentage. In ordinary practice with weak cereal diluents this is, however, a refinement not often required.

It should be noted that the commercial pasteurizing of milk interferes greatly with the making of milk-mixtures from the different layers. Indeed, it is practically impossible to produce a food of a fat content sufficiently low for many cases, and the feeding of an infant with fat intolerance is almost an impossibility. My attention was drawn to this fact by my failures with what I had supposed was food of a low fat content, and the failures explained by the discovery that the milk had been commercially pasteurized. With such milk we have no certainly of our ability to make a food containing less than 1.5 per cent. of fat, even if using only the lower 8 ounces of the quart, unless we dilute this with water, and in that event the caloric value is reduced far too greatly. A few examinations which I have made gave approximately: top 8 ounces, 10 per cent. fat; top 16 ounces, 6 per cent., and lower 8 ounces, 1.5 per cent., but these are not to be depended on as average figures. This condition is due to the well known effect of pasteurizing in preventing a satisfactory and uniform rising of the cream. Whenever possible when layer milk is to be employed, it should be procured in the jar unpasteurized, as pure as can be obtained, the mixture prepared, and this then pasteurized in the individual feeding bottles.

From the card has been omitted with full intention any tabulated rules for feeding milk-mixtures varying in strength according to the age. My belief is that such rules, though convenient, are unnecessary; and indeed very frequently harmful by teaching the physician to depend on printed age rules rather than on the personal observation of the individual case. It may produce the same effect in taking away his power to think for himself that comes from following the directions for age which uniformly accompany the proprietary foods on

the market. In instructing students I emphasize always the great importance of beginning with a formula much weaker in protein and especially in fat than the actual needs of the infant demand; and then, after tolerance for the artificial food has been established, of increasing the strength of the mixture to the extent to meet the infant's needs, as shown by the gain in weight and the general good condition of health. To go beyond this in quantity or strength of food merely because rules for age say it should be done is a sure way of inviting disaster. The method I have mentioned is, I believe, all that is required by the observing and intelligent man; and the unintelligent cannot be really helped by printed rules in which the age is made the chief guide.

A COMBINED TEMPERATURE, WEIGHT, FOOD, SYMPTOM, ETC., RECORD CHART FOR PEDIATRIC WORK*

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The putting down on one sheet in a graphic and easily legible form the most important factors concerned in determining the picture and the course of a disease, as well as the therapy instituted to control it, is obviously a great advantage over the old and still quite universally practiced method of using different sheets for different data. The newer method not only saves much time, but enables one to correlate at a glance many of the observations into a picture of the whole. The idea is not original, as it was seen and used by one of us in its developed form in 1910 at the Kaiserin Augusta Victoria Haus in Charlottenburg.

The chart of this institution was ruled for thirty-one days, and was a most elaborate affair, providing not only for recording the temperature, pulse, respiration, weight, food, stools, symptoms, treatment, calories, etc., but also for various data regarding the parents, the confinement, the diagnosis and condition on admission and discharge, etc. In consequence it was awkwardly large, measuring approximately 15¼ by 20½ inches, and in addition the proportion of the length to the width of that part of the chart recording the weight made the angle of the weight curve too acute, about 23 degrees for a daily gain of 30 gm., which, according to Heubner, as quoted by Langstein and Meyer,[1] should be 39° 45′ for an average daily gain of 26.6 gm. during the first three postnatal months. These dimensions also made impossible much of a rise or fall in the weight chart, except as a result of a very large gain or loss, 20 gm. gain or loss causing a movement of the curve for a vertical distance of but 7/8 of an inch. Finally, the temperature, pulse and respiration charts could hardly be ruled accurately with an economic use of time, as no vertical rulings existed in the chart, except the lines separating one day from the other. On

* From the Babies' Dispensary and Hospital, City Hospital and Lakeside Hospital, Cleveland.

1. Langstein and Meyer: Säuglingsernährung und Säuglingsstoffwechsel, J. F. Bergmann, 1910, p. 41.

the whole, however, this chart was an improvement, and it was with the idea of applying its good points to our local hospital records that the present chart was devised.

As it was our idea to have all of the pediatric wards in which local medical school teaching was being carried out use the same charting and recording scheme, in order to aid in making the whole department uniform, we were bound closely to the present forms and sizes of the records of Lakeside Hospital and City Hospital, the Babies' Dispensary having adopted for its Out-Door Ward no rigid form or size of chart. Consequently, the largest electrotype that we could use was one measuring 8⅝ inches in width and 10⅝ inches in length, which at Lakeside Hospital had to be printed on paper measuring 8⅝ by 11 inches, while at City Hospital and at the Out-Door Ward of the Babies' Dispensary and Hospital the more spacious sheet of 9½ by 12 inches could be used. Our present ideas regarding a more ideal size will be indicated further on.

In the chart here presented the following innovations or changes have been made:

1. The space for the recording of the weight and food has been given dimensions which make possible the formation of a weight angle of about 35 degrees with a daily gain in weight of about 30 gm.

2. As a result of this change there has been made available more space for the recording of "Treatment" and "Symptoms." In this connection it may be said that the symptoms are not described in detail, but simply given in an appellative manner. Whenever a detailed description is desirable, this must be noted in the regular history sheet.

3. The space for the individual day has been divided by three vertical lines into four spaces. This arrangement makes it possible for the nurse quickly and easily to find the correct space for the notation of the temperature degree and pulse and respiration rates, according to the hour of the day. By dividing the daily space into four parts, it is possible to make an accurate notation of the pulse, respiration, etc., every twelve hours, every six hours, or every three hours. While the space for the last is small, yet experience has shown that it is ample, owing to the ever-present oscillation in the different curves.

4. The second of the third vertical lines mentioned under 3 has again been divided into ten equal parts, so that it really is an equally divided dotted line. This has been done to give the recording nurse an accurate and rapid guide for the notation of the temperature degree,

the weight figure and the pulse and respiration rates. The last two are not frequently recorded, however, so the division is usable mainly in the registering of the temperature curve and the weight curve. Although the weight curve occasionally goes down into the food space, the dotted line has not been extended down beyond the space for the registering of the temperature curve, in order sharply to differentiate the one large space from the other.

5. The space for the recording of stools has been divided into the two periods, a. m. and p. m., and it has also been increased in size, in order that the individual stools might be described if desired.

6. The electrotype has been printed in a light coffee-brown or a light gray, in order that the colors used in recording the temperature, pulse, weight, and respiration might stand out more clearly. Von Pirquet has also used a different color than black for his charts, but the one he chose, a brownish-yellow, is difficult to see with artificial light.

At the Kaiserin Augusta Victoria Haus, a color scheme was used for the charting of the different food mixtures. In one department of that institution different colored and gummed paper slips were properly pasted into the food space, while in the other department the different colors were put on the food chart by using crayons. The former scheme is possibly somewhat neater, but also more complicated, as the various food modifications require a definite color of their own. With the crayon method fewer colors are necessary, because two colors can be used together in a corresponding proportion to designate the corresponding quantity of the foods as they exist in the food mixture, and if a nurse is at all careful and sketches the colors with a light hand, a very neat and permanent record can be made with simple and inexpensive crayons that can be purchased in the market.

On the pediatric service at Lakeside Hospital the chart and the following definite color and figure scheme have been used exclusively for fifteen months consecutively, so that a practical test really has been obtained.[2] Only a few minor changes in recording the feedings have been made.

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2. Much credit and appreciation in this connection are due Miss L. O. Essery and Miss M. Francis, head nurses of Wards A and K, Lakeside Hospital.

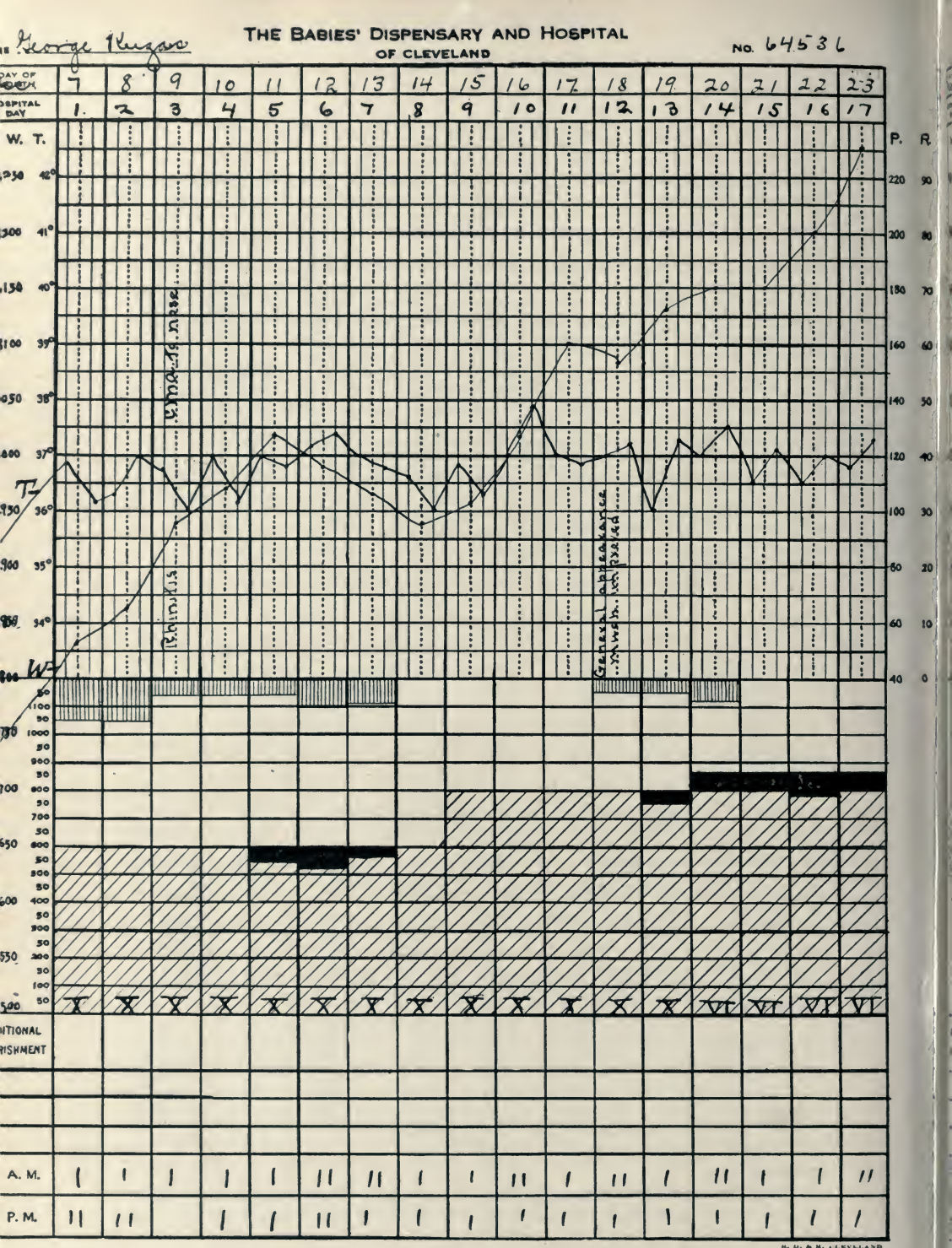

Fig. 1.—Example of authors' chart in use. The black line marked "T" is the temperature curve; the line marked "W" in the original chart is in red ink and is the weight curve. The portion shaded with diagonal lines represents Synthetic Milk Adapted and in the original chart in practical use is colored violet. The portion shaded with vertical lines represents water and in the chart in practical use is colored magenta. A complete description of the color scheme and other data recorded on the charts will be found in the text. About two-thirds actual size.

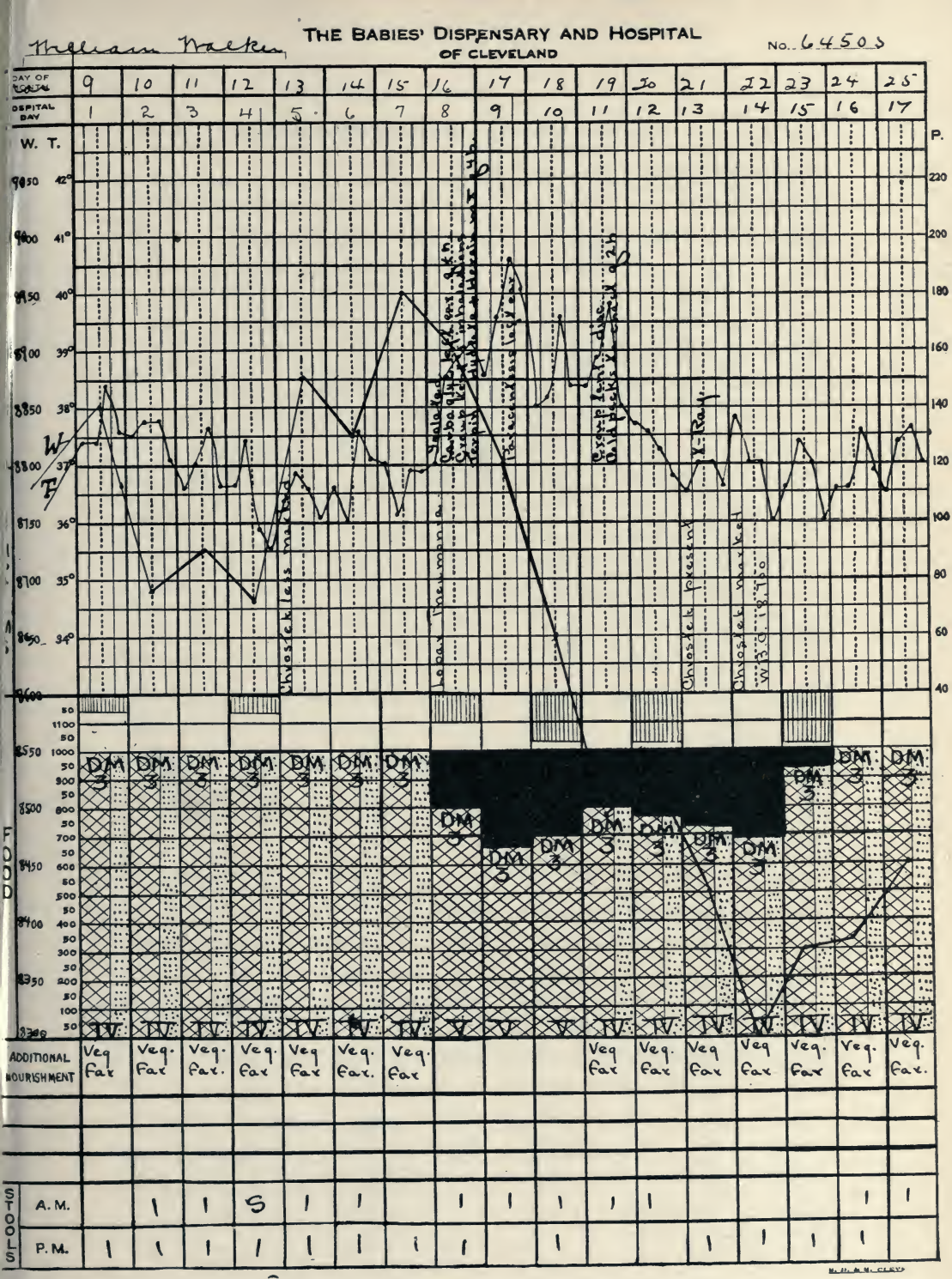

Fig. 2.—Another example of authors' chart. The lines T and W indicate temperature and weight curves, respectively. The lattice hatching represents whole milk and in the chart in practical use this area is colored ultramarine blue; the dotted columns represent oatmeal water and in the chart as used in the hospital the area is colored English vermilion; the portion shaded by vertical lines represents water and in the chart in use is colored magenta. About two-thirds actual size.

Food Chart.—The colors named have been used to designate the following foods:

Whole milk, ultramarine blue
Skimmed milk, prussian blue
Whey, cobalt blue
S. M. A., violet
Plain buttermilk, chrome green, light
Koeppe's buttermilk, olive green
Casein milk, green, medium
Water, magenta
Oatmeal water, English vermilion
Barley water, madder lake
Potato water, Indian red
Cornstarch water, venetian red
Keller's soup, burnt umber
Keller's soup, modified, gold ochre
Tea, yellow
Breast milk, orange
"Refused," black

The total amount of food taken is sketched into the proper space of the food chart. If the amount taken does not correspond to the amount ordered, the difference is sketched in black above the amount taken, so that the space filled in with black designates the amount refused, and the total space occupied by both black and the food color represents the total amount ordered. As a result of this innovation of charting the amount refused in the manner described, one obtains a beautiful picture of the appetite of the child.

If it is desirable to note the amount of water taken by the child besides the food, this is either noted in one of the free spaces below the "Additional Nourishment" space or (and this is the plan which we have adopted) it is charted in the daily "Food" space, in the color corresponding to water, just as the food is charted in the same space, except that the amount of water taken is charted from the top down and the food from the bottom up.

The actual mixtures in the daily food are indicated in direct proportion in the color scheme. So, if an infant is to have one-third milk and two thirds oatmeal water, one-third of the daily food space up to the figure representing the amount taken is colored with ultramarine blue, and two-thirds with English vermilion.

The percentage and kind of carbohydrate or salts (sodium chlorid, sodium bicarbonate) added to plain water or to the different food mixtures are indicated by writing with a hard black crayon, in the upper part of the food color column, the following letters and figures:

L = Lactose
S = sucrose
D = dextrose
Lv = levulose
DM = dextri-maltose
M = Mellin's food
MS = malt soup
SC = sodium chlorid
SB = sodium bicarbonate
1 = 1 per cent. of total mixture
1½ = 1.5 per cent. of total mixture
2 = 2 per cent. of total mixture
2½ = 2.5 per cent. of total mixture
3 = 3 per cent. of total mixture, etc.

So the appearance of "3 S" just below the top of a 600 c.c. color column, representing one-third milk and two-thirds oatmeal water, would indicate that 18 gm. of sucrose had been added to the total to make a 3 per cent. addition of sucrose to the 600 c.c. mixture of one-third milk and two-thirds oatmeal water.

The number of feedings in twenty-four hours is noted just above the bottom of the color column for a given food mixture by writing in black with a crayon, Roman figures corresponding to the number of feedings ordered. In the foregoing example a "VI" in black at the bottom of the 600 c.c. column — one-third milk and two-thirds oatmeal water—would mean that the child was to receive 6×100 c.c. in twenty-four hours.

If a change in the food should be ordered, and so during one day a child receive two kinds of foods, the first mixture given is sketched at the bottom of the column and the second directly above it.

Illustrative examples of most of the points just made can be found in the accompanying charts.

Additional Nourishment Notes. — The additional nourishment column is used for the recording of vegetables, cereals, zwieback, etc.

Weight, Temperature, Pulse and Respiration Chart.—The weight curve is sketched in red ink (W); the temperature curve in black ink (T); the pulse curve in purple ink; and the respiration curve in green ink.

Symptoms and Treatment Notes.—The treatment notes are written in red ink on the chart by the nurse, and the symptoms in black ink by the intern or clinical clerk. Two colors are used clearly to separate these contiguous notes, and the black has been used for the recording of the symptoms simply because it is desired to make these notations during the ward visit or immediately after, and, under these circumstances, black ink is at all times available, in the form of the ordinary black ink fountain pen, for every intern and clinical clerk.

Stool Chart.—The color scheme has also been utilized, together with the sign scheme, in the recording of stools.

The following crayon colors are used to indicate the following stool colors:

Crayon	*Stool*
Chrome yellow, medium	Lemon yellow
Gold ochre	Yellow-brown
Orange	Orange-carrot yellow
Madder lake	Beet red
Chrome green, light	Yellow-green
Chrome green, dark	Green
Olive green	Gray-slate
Burnt umber	Brown—Keller's, older children, hemorrhage
Black	Bismuth—old blood

| = formed soft stool.

\ = semi-solid, soft stool of salve-like consistency.

\ = a thin stool whose consistency is between a watery stool and a semi-solid, salve-like stool. In many children this is not abnormal.

— = watery stool and abnormal, as far as consistency is concerned.

~~~ = squirting, watery stool seen only in marked diarrhea.

′ = mucus, slight in amount.

″ = mucus, medium in amount.

‴ = mucus, marked in amount.

c = choppy, stringy stool, usually greenish-yellow and with mucus = dyspeptic stool.

C = casein curds.

s = soft, putty-like, or partly sandy, semi-solid, gray, yellowish-gray, or greenish-gray fatty soap stool.

S = hard, dry, pale gray, very light yellow or green-gray fatty soap stool.

F = soft, thin, shiny fatty stool, usually yellowish.

b = blood streaked on outside of stool, usually bright red and mechanical in origin.

B = blood, mixed well with stool and usually with pus, of a brown-red tomato-sauce color, seen mainly in enteritis follicularis.

H = blood, bright red or dark brown or black, when very large in amount. and due to hemorrhage, as in intussusception, typhoid or hemorrhagic diseases.

P = pus, usually mixed with blood, in enteritis follicularis.

Metric System.—It will be noticed that only the metric system has been used in this chart. This is in conformity with the plan which one of us inaugurated at the Babies' Dispensary during 1906, since which time all of the weight amounts, temperature degrees, and food amounts have been determined according to the metric system, not only for the physicians and nurses, but for the public as well, and it has been continued for added reasons: (1) in practically all scientific work of the various civilized countries the metric system is used, and (2) we believe that if it is more generally used in practical institutions like hospitals, dispensaries, etc., it will help toward its adoption by the public at large for their own daily personal use.
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Pasting of Chart Sheets.—Even with the smallest sheet, 8⅝ by 11, it is possible, if so desired, to make one continuous chart out of the individual seventeen-day chart sheets by simply using a photographic trimming knife and library paste.

Ideal Chart Size.—Earlier in the article it was indicated that the form of the chart as presented today was determined by local conditions, and that ideally we should prefer a somewhat different form. From the experience which one of us has had at Lakeside Hospital during a period of fifteen months, this ideal electrotype size should at present measure $9\frac{23}{24}$ inches wide by $13\frac{14}{15}$ inches long. The increase in width would add three days to the chart, making a total of twenty days. The increase in length of the present chart is applied as follows:

1. The "Temperature" space is increased to 6¾ inches.

2. The "Food" space is increased to $4\frac{1}{20}$ inches.

These alterations will change the angle of the weight curve for a daily gain of 25 gm. to 37° 21′, which would correspond with Heubner's figures of 39° 45′ for an average daily gain of 26.6 gm. This change also gives still more space in the "Symptom" and "Treatment" columns for the respective notations.

3. The "Additional Nourishment" space is increased to $\frac{35}{48}$ of an inch.

4. The blank spaces for extra notes under the "Additional Nourishment" space are increased in number from three to four.

This new form could be printed on paper measuring 10 by 14⅜ inches, corresponding with 8⅝ by 11 in the present chart, or better on a larger sheet measuring 10⅞ by 15⅜ inches, corresponding with 9½ by 12 in the present chart.

KALA-AZAR IN A CHILD (THE FIRST AMERICAN CASE)

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BOSTON

History.—K. K., a girl, was born in Greece, Aug. 12, 1912. She entered the Childrens Medical Service of the Massachusetts General Hospital, Aug. 15, 1916. Her parents were Greek, and reported that, although they themselves were well, they had lost the first two children, in Greece, of a disease similar to that from which this child was suffering.

The patient came to America in December, 1915. In January, 1916, she had pneumonia, followed by anemia and enlargement of the abdomen. Coincidently, she became weak and listless, and the symptoms became severe enough to bring her to the hospital.

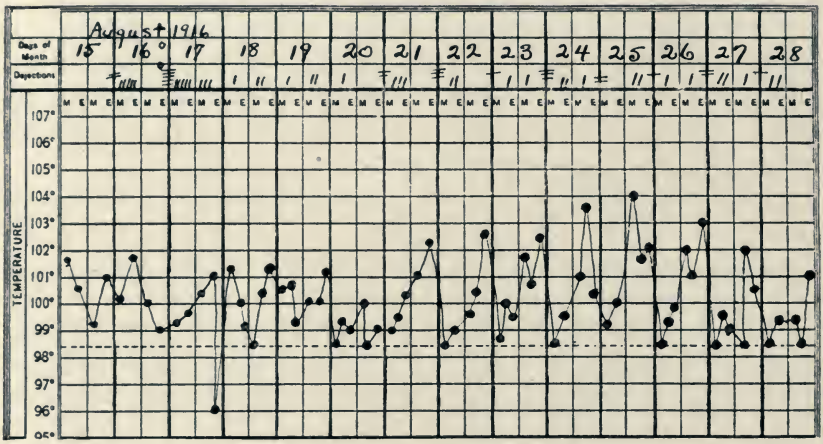

Fig. 1.—Sample of characteristic temperature for a period of two weeks.

Physical Examination.—The physical examination showed a pale, poorly nourished, white girl of normal intelligence. The head was symmetrical, and measured 48.5 cm. The pupils were equal and reacted to light. The ears, and ear drums were normal. The throat was normal. The heart dulness to percussion extended 2 cm. to the right and 6 cm. to the left of the midsternum. There was a slight systolic murmur over the precordia; the sounds were otherwise normal. The lungs were normal. The abdomen was very large, and when the child was prone, extended above the level of the thorax. The liver edge was palpable 4.5 cm. below the edge of the ribs in the nipple line. The spleen was very large, the tip being 4.5 cm. below and 3 cm. to the right of the umbilicus. The notch was easily felt. There were several patches of leukoderma, the size of a dime, on the chest. The reflexes were normal, and there was no enlargement of the peripheral lymph nodes.

The blood picture, shown in the accompanying table, with a low platelet count, 121, 324, led us to believe that we were dealing with an aplastic splenic anemia. The urine was normal on all examinations, except that now and then it contained the slightest possible trace of albumin, and a few red blood cor-

Fig. 2.—Photograph of authors' patient taken Feb. 5, 1917, four months after splenectomy.

puscles. The temperature chart was found, later, to be characteristic in its irregularity. The accompanying four-hourly chart (Fig. 1) is a sample of two weeks which were typical of the course, during several months.

Operation and Course.—Despite all treatment, the child lost weight and strength. Citrate of iron given subcutaneously was without any benefit. It was then decided to remove the spleen, but, because of the anemia, the operation was preceded by transfusion. Sept. 30, 1916, 200 c.c. of blood were introduced into the patient's anterior jugular vein by the indirect method (donor's blood, Group IV, patient's blood, Group IV).

BLOOD EXAMINATIONS DURING THE COURSE OF THE DISEASE

Date	Hemoglobin	Red Count	White Count	Differential Count					Remarks
				Small Lymphocytes, per Cent.	Large Mononuclears, per Cent.	Polymorphonuclears, per Cent.	Transitionals, per Cent.	Eosinophils, per Cent.	
8/15/16	32 Dare	2,460,000	3,000	41	38	15	6	...	Reds slight achromia; very little variation in size; no malaria; no parasites or blasts
8/18/16	45 Sahli	2,240,000	2,800	52	28	15	5		
8/23/16	29 Dare	1,800,000	2,600	61	22	15	2		
8/31/16	29 Dare	2,000,000	1,600	61	22	15	2		
9/ 3/16	23 Dare	1,696,000	1,600	17	80	3			
9/10/16	30 Dare	1,676,000	1,500	61	24	15			
9/20/16	25 Dare	1,960,000	1,600	42	37	20	1		
9/27/16	10 Dare	1,700,000	1,600	13	81	6	..	...	Two nucleated reds to 100 whites
9/29/16	.....	.....	.....	..	..	..	..	...	Transfusion
10/ 1/16	50 Dare	2,400,000	4,600	16	76	6	..	...	Slight variation in size and shape; no blasts or Jolly bodies
10/ 3/16	50 Dare	2,800,000	4,800	34.5	34.5	25	5	...	
10/ 5/16	40 Dare	3,000,000	4,800	19	59	16	4	4	
10/ 6/16	.....	.....	.....	..	..	..	..	...	Splenectomy
10/ 7/16	.....	3,520,000	.....	18	14	66	2	...	Twenty-three normoblasts, seven megaloblasts, to 100 whites
10/ 8/16	70 Dare	.....	5,000						
10/ 9/16	65 Dare	.....	4,800	14	5	81			
10/12/16	.....	.....	7,500						
10/17/16	65 Dare	3,456,000	6,600						
10/21/16	.....	2,912,000	6,800	..	..	..	..	...	One nucleated red
11/21/16	70 Dare	4,250,000	15,000	51	13	28	8	...	No nucleated reds
11/29/16	.....	4,260,000	17,000	42	2	54	2		
12/15/16	70 Dare	4,500,000	18,000	47	2	51			
12/24/16	65 Dare	3,840,000	13,000	38	27	33	2	...	Six nucleated reds per 100 whites
1/ 1/17	70 Dare	3,968,000	12,500	30	20	43	7		
1/ 9/17	65 Dare	3,408,000	15,000	17	20	59	4	...	Number of normoblasts and stipple cells
1/23/17	60 Dare	3,288,000	14,400	31	7	55	7		
2/ 5/17	75 Dare	3,976,000	18,000	33	8	54	5	...	Achromia; polychromatophilia
2/13/17	75 Dare	4,432,000	20,600	35	3	54	4	...	Some normoblasts; ++ platelets
2/23/17	75 Dare	3,864,000	18,400	22	7	57	4	3	
3/ 8/17	75 Dare	4,240,000	21,000	46	4	45	2	3	No nucleated reds, ++ platelets
3/28/17	75 Dare	.....	20,000	71	1	25	..	3	No nucleated reds; platelets normal
3/16/18	95 Talq.	6,640,000	17,400	15	63	21	..	1	

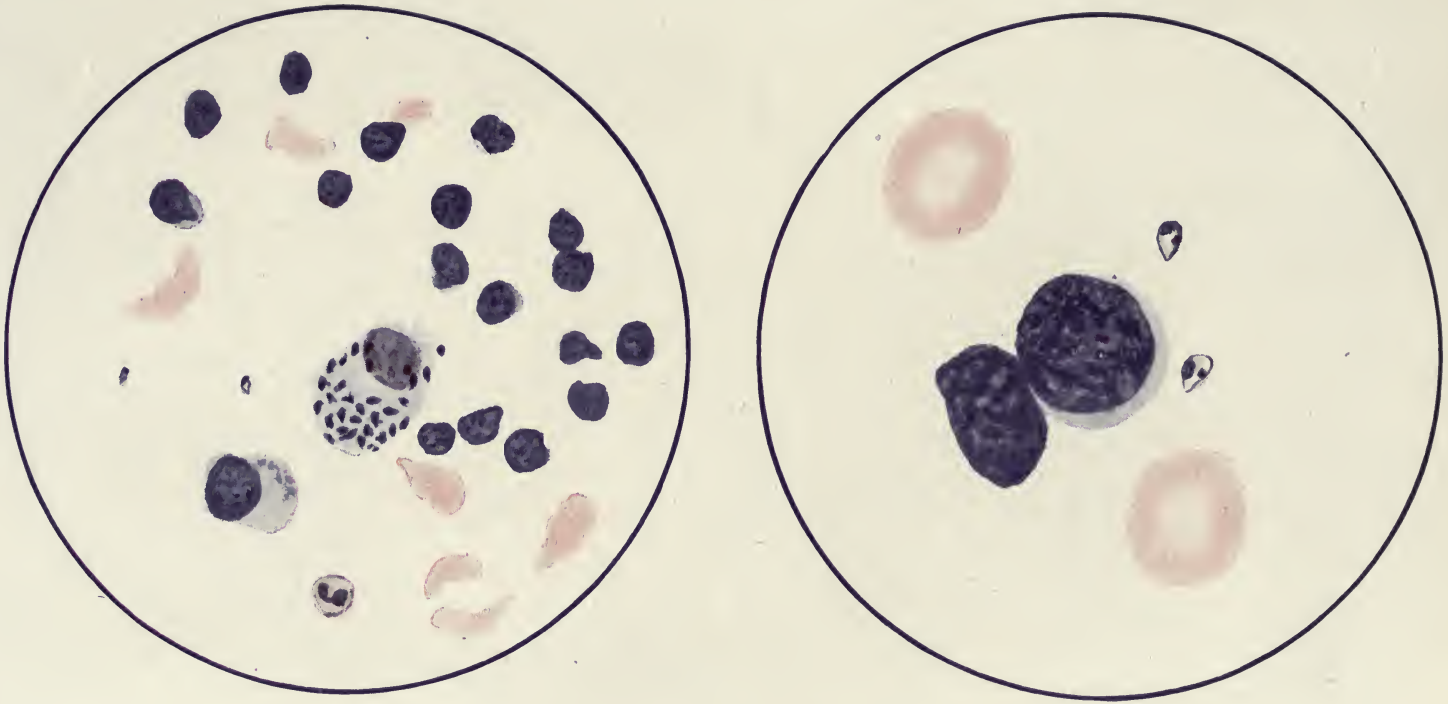

Fig. 3.—Kala-azar. I. Actual field. Smear from fresh spleen showing many of the Leishman-Donovan bodies enclosed in a large endothelial phagocyte. (Wright's stain.) II. Morphology. Single Leishman-Donovan bodies compared in size with lymphocytes and red corpuscles. (Wright's stain.)

October 6, splenectomy was performed by Dr. Beth Vincent, and a spleen, weighing 330 gm. was removed. The average weight of the spleen at 4 years is 42 gm.[1] The convalescence from the operation was without incident (Fig. 2).

Examination of Spleen.—The spleen on section was firm, of a reddish color, and showed small, whitish areas scattered throughout. A striking feature of the hematoxylin stained section was a large endothelial phagocyte cell filled with dark blue staining spherical figures of fairly uniform appearance (Fig. 3, colored plate). There were large numbers of these cells scattered throughout the splenic pulp. Smear from the spleen, stained with Wright's blood stain,

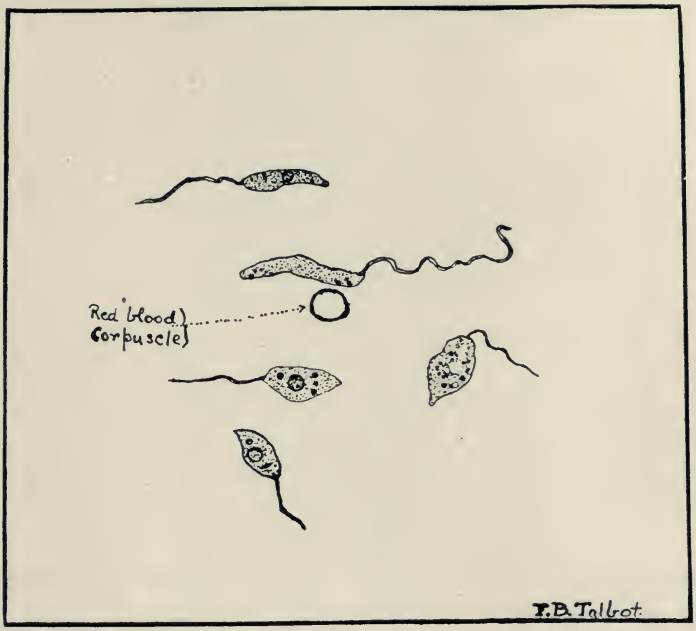

Fig. 4.—Culture of Leishman-Donovan bodies from inguinal gland of patient, K. K.

showed bodies about the size of blood platelets. These bodies had a sharply outlined, blue-staining periphery, and an unstaining central portion, which contained two purplish staining structures. One of these structures was generally oval, sharply outlined, and occupied a part of the periphery. The other structure was smaller, more intensely stained, and had a red shape. These bodies were identical, in microscopic appearance, with *Leishmania infantum.*

Following the removal of the spleen, the child was noticeably better; she gained in weight and color, and was much more contented and happy. A blood culture at this time (October 31) was negative. A small inguinal gland was removed for diagnosis, and from it Dr. A. W. Sellards was able to cultivate high, motile, flagellated organisms in large numbers (Fig. 4).

1. Gundobin: Die besonderheiten des Kindesalter, Berlin, 1912, p. 172, Table 36.

Subsequent Treatment and Outcome. — Intramuscular injections of atoxyl were given, beginning November 2, for one month, without any apparent effect on the course of the disease. She subsequently commenced to lose weight and

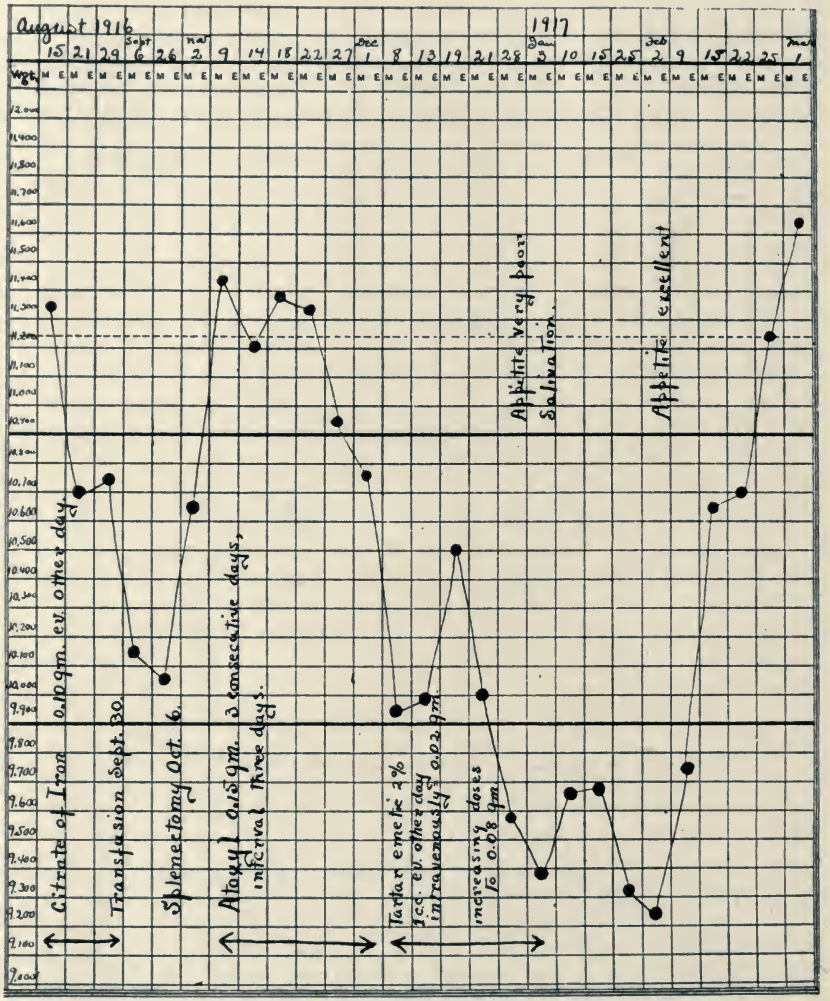
August 1916
1917
Citrate of Iron 0.10 gm. ev. other day
Transfusion Sept. 30.
Splenectomy Oct. 6.
Atoxyl 0.15 gm. 3 consecutive days, interval three days.
Tartar emetic 2% 1 c.c. ev. other day intravenously = 0.02 gm.
increasing doses to 0.08 gm.
Appetite very poor Salivation.
Appetite excellent

Fig. 5.—Weight chart, showing operations and medication.

strength rapidly and continued to run an irregular, intermittent temperature. The liver continued enlarged.

Following the suggestion of Sir Leonard Rogers,[2] a course of intravenous tartar emetic was commenced December 8. At first 1 c.c. of a 2 per cent.

2. Rogers: Lancet, London, Nov. 4, 1916.

(0.02 gm.) solution was given daily, and later every other day, in increasing amounts up to 0.08 gm. When the tartar emetic was commenced the daily temperature varied between 99 and 104 F. One month later it had gradually

Fig. 6.—Photograph of child taken March 18, 1918, after having been home for one year.

subsided, and remained normal, with the exception of four days, until the child was discharged from the hospital. At one stage of its administration she was bothered by a cough, salivation, and loss of appetite, was irritable and cross, and remained in bed all day. The tartar emetic was, therefore,

omitted; the appetite commenced to improve and the other symptoms cleared up. In the meantime an abscess had developed at the site of one of the tartar emetic injections, causing the child considerable discomfort. After this was drained there was a marked and continuous improvement in general health and weight; she started to play around the ward and the size of the liver diminished, so that, on discharge, it could only be felt 2 cm. below the edge of the ribs. The child was discharged from the hospital apparently cured, March 28, 1917.

The accompanying weight chart (Fig. 5) shows the operation and medication during the period the child was in the hospital.

The child was seen in March, 1918, after having been home for one year. During the interval she was perfectly well, with the exception of having had diphtheria. Her physical examination showed that she was now well developed and nourished, with no enlargement of the peripheral lymph nodes, except a very small gland in one groin, the size of a Number 8 shot. The heart, lungs and abdomen were normal. There were no masses felt. The liver edge was palpable just under the edge of the ribs. Her height was 94 cm., and she weighed 34½ pounds. So far as could be determined, she was an absolutely normal, healthy, well child (Fig. 6).

DISCUSSION

So far as the authors know, this is the first case of infantile kala-azar reported in America. The disease is common in India, Asia Minor, and along the shores of the Mediterranean Sea. A few cases have been imported to England from these countries.

The parasites which bear the name of the Leishman-Donovan bodies were discovered by these investigators in 1903. They are also found in dogs, and it seems probable that fleas transmit the disease from dogs to man.

The incubation period is variable. It may be as short as ten days or as long as several months.

The onset of the disease is usually insidious, but it may commence with chills and high fever. The fever is intermittent or remittent, the temperature chart often showing two remissions in twenty-four hours. The fever tends to last six weeks or longer and then declines. During the period of pyrexia the spleen and liver become enlarged, and through the course of the disease there is progressive loss of weight and increased anemia.

The duration of the disease varies, death usually occurring within a year from weakness or some complication. The prognosis is, therefore, bad.

Treatment up to date has been unsatisfactory. Tartar emetic 2 per cent. solution, may be given intravenously, as recommended by Rogers.

It is impossible to say whether K. K. was cured by the tartar emetic or not, but the permanent improvement seemed to result from its administration. Further observations confirming these findings, and those of Rogers,[3] must be made before it can be accepted to be of proved value. Improvement from splenectomy is, as a rule, only temporary. Other methods of treatment are without value.

311 Beacon Street.

3. Rogers: India Med. Gaz., 1917, **52**: July and August.

IMMUNITY REACTIONS IN HYDRATED AND CONCENTRATED TISSUE *

F. W. SCHLUTZ, M.D.
MINNEAPOLIS

That certain types of organisms succumb more readily to the invasion of disease than others is an old clinical observation. This gradually crystallized into the expression that the apparently fat, plethoric organism showed on the whole a lesser degree of resistance than the lean, fairly emaciated organisms. This experience is quite strikingly borne out in two familiar disease processes; the pneumococcus infection and tuberculosis.

If one will look on certain types of obese organisms as having tissue with a larger water content than the thin, lean organism one may use the expression that in the former case we are dealing with hydrated tissue and in the latter case with concentrated tissue. That hydration or concentration of tissue bears some definite relationship to immune reactions unfavorable in the hydrated and favorable in the concentrated tissue is a thought which has repeatedly been expressed in the literature.

REVIEW OF THE LITERATURE

Among pediatrists, Czerny[1] and his followers have mentioned the possibility of this connection and have published some interesting observations bearing on the point. Czerny emphasizes the connection existing between a state of nutrition and the natural immunity of an organism, and states in fact, that natural immunity is dependent on the state of nutrition. He points out that there are differences between the natural immunity of different tissues and organs and explains in this way the localization of infectious disease processes.

Congenital factors can affect the development of immunity as well as changes wrought during the advancing age of the tissue.

Czerny finds that natural immunity is least developed in the premature, very slightly during the first few years, and shows a maximum development during adolescence and middle age. From clinical experi-

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1. Czerny, A.: Med. Klin., 1913, No. 23, p. 895.

ence he comes to the conclusion that the infant who can tolerate the largest amount of fat in his food shows the best natural immunity. High carbohydrate feeding while generally well tolerated, lowers immunity to an unusual degree. Infants with a higher water content in the tissues are very vulnerable to infection. Premature and newly born infants are easily infected. There is little tendency to localization. The infection quickly becomes general. The infection with tuberculosis, for example, is a striking instance.

In this connection the experimental work of Weigert[2] on young pigs infected with tuberculosis is interesting. He found that the pigs fattened on high carbohydrate feeding whose tissues were in a state of hydration, as it were, showed an exceptionally low resistance to the infection as compared with normal pigs or those fed on mixtures predominating in fat content. Weigert believes that there is a definite connection between natural resistance and the water content of the tissues. It is probably one of a series of biologic physical or chemical factors which influence or modify the constitution of the organism and on which immunity depends.

The laws governing the behavior of the water content of the tissues of various animal species are today still the same as those expressed and formulated by V. Bezoldt[3] over fifty years ago. Every individual animal organism has a content of water, organic material and inorganic salts, typical for its age and species. This is either nearly constant or it may vary between wide degrees.

The growth and development of every animal is characterized by changes, typical for each species, in the composition of the above named components. These changes are principally:

(a) Decrease in the organism of water and volatile components from the embryonal stage until the period of free growth.

(b) Increase in content of solid inorganic material. This increase being particularly rapid for the first period after birth.

(c) A steady growth, although extremely slow during the first period of life, of the ash content. This growth continues until the completion of the period of progressive development.

Weigert's[4] experiments confirmed generally the above laws. He concludes that the water content of the animal's tissue depends on its

2. Weigert, R.: Berl. klin. Wchnschr., 1907, No. 23, p. 1209.
3. Bezoldt, V.: Ztschr. f. Wissenschaftl. Zool. **8**:487, 1857.
4. Weigert, R.: Jahrb. f. Kinderh. **61**:178, 1905.

age and nutrition. Variations of the water content are not alone determined by increase or decrease of the fat content of the animal organism, but are also determined by a varying content of fat-free, dry substance. The increase of fat-free, dry substance involves equally the content of nitrogen and ash. Animals fed on protein and fat-rich food show the largest content of fat-free, dry substance. Applying his results to the infant organism, Weigert concludes that the breast-fed infant's organism has a lower water content than the artificially fed on account of the greater fat percentage of breast milk.

TABLE 1.—COMPARATIVE RESULTS OF THE EXPERIMENTS UNDERTAKEN TO DETERMINE THE LYSIN REACTION

Fat Animals (High Carbohydrate Feeding) (Immunized with Sheep Cells)				Lean Animals (Balanced Ration) (Immunized with Sheep Cells)			
	Initial Weight, Gm.	Final Weight, Gm.	Hemolysis		Initial Weight, Gm.	Final Weight, Gm.	Hemolysis
Series I				Series I			
Pig 1	280	630	0.08	Pig 13	250	190	0.04
2	355	840	No hemolysis	14	335	200	0.06
3	320	865	0.06	15	305	185	0.06
4	270	665	0.08	16	275	195	0.08
5	300	870	0.06	17	315	210	0.08
6	310	785	0.08	18	295	185	0.06
							partial 0.05
Series II				Series II			
Pig 25	400	700	complete 0.06	Pig 30	480	310	0.04
			partial 0.04				
27	375	780	complete 0.1	32	435	350	0.06
28*	405	615	complete 0.04				
Series III				Series III			
Pig 40	345	825	No hemolysis	Pig 41	460	365	0.08
43	425	920	0.08	42	395	250	0.06
45	450	940	0.06	48	360	250	0.03
59	395	985	0.08	49	405	295	No hemolysis
				60	400	290	0.02
				61	415	325	0.04
Series IV				Series IV†			
Pig 52	265	655	0.08	Pig 54	335	350	0.08
53	270	600	0.08	55	450	515	0.06
				57	390	370	0.08
				58	400	385	0.06

* Pig had lost 235 gm. in past two weeks.
† Stationary weight.

The coincidence of diminished water content of the organism with increased resistance to infection explains the natural immunity of the breast fed infant. The question here might be raised whether this is the only factor operative in this higher degree of resistance. It is now a known fact that immune bodies can pass from the mother to the nursing offspring through the breast milk.

R. Lederer,[5] studying the relationship of water to constitution and nutrition, reports the interesting finding that one-sided feeding of young animals on cow's milk, dogs in this case, caused the normal, physiologic dehydration of the growing organism to remain stationary, or even could cause increase in the water content of the blood. Excessive intake of fluid along with other food could delay the drying out of the organism. The same thing could be accomplished by continuing breast feeding beyond the physiologic period of weaning. Lederer finds that the curve of physiologic dehydration shows an abrupt interruption shortly after birth. The water content of the blood of the new-born increased from birth until about the middle of the third month. From this period on, the slow physiologic dehydration continues to adolescence.

These findings are of some interest in connection with the view expressed by Czerny in reference to immunity in the young, under conditions of natural and artificial feeding. A part phenomenon of natural immunity is the capability of the organism to react to an infection with the formation of specific immune bodies. Most of the recent experimental work has for this reason been along immunologic lines, and has concerned itself with a search for these immune bodies and with a study of their behavior under varying conditions.

Moro[6] found complement in the serum of the fetus and the new-born in an amount virtually equal to that of the adult. In the breast-fed infant it reaches this amount as early as the fourth or fifth day, and remains quite constant. The conditions are much the same in the artificially fed infant, except that there are variations in the amount and frequently diminution. He found the complement content of the atrophic infant and those suffering from alimentary disturbances far below the normal, and found that it could be markedly influenced by nutrition.

Adair[7] found hemolytic complement in the new-born babe and could demonstrate it in fetuses as early as the eighteenth week of fetal life. It was present in smaller amounts in the fetal than in the maternal serum. He concludes from his experiments that the hemolytic complement is developed in the fetal blood and that the amount developed is controlled by the fetal organism.

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5. Lederer, R.: Ztschr. f. Kinderh. **10**:365, 1914.
6. Moro, E.: Monatschr. f. Kinderh. **6**:340, 1907.
7. Adair, F. L.: Tr. Am. Gynec. Soc., 1915.

Heiman[8] found the actual and potential complement content of the blood reduced in the artificially fed infant. Kaumheimer[9] could not corroborate the findings of Moro, but found the complement content high in the organism favored with an apparently normal constitution, but distinctly lower in the organism with abnormal constitutional manifestation.

TABLE 2.—RESULTS OBTAINED IN DETERMINING THE PRECIPITIN REACTION

Fat Animals (High Carbohydrate Feeding) (Immunized with Ascitic Fluid)				Lean Animals (Balanced Ration) Immunized with Ascitic Fluid)			
	Initial Weight, Gm.	Final Weight, Gm.	Precipitation		Initial Weight, Gm.	Final Weight, Gm.	Precipitation
Series I				Series I			
Pig 7	350	910	—	Pig 19	275	180	—
8	265	595	—	20	300	195	—
9	250	740	—	21	280	190	—
10	280	635	slight	22	305	185	slight
11	300	825	—	23	295	200	—
12	280	710	—	24	310	195	—
Series II				Series II			
Pig 33	385	635	trace, layer test	Pig 37	395	310	—
34	300	670	—	39	415	250	—
(Immunized with Human Serum)				(Immunized with Human Serum)			
Series III				Series III			
Pig 44	380	750	slight	Pig 50	415	250	—
46	610	1,035	—	51	435	385	—
47	435	830	—	62	390	295	—

E. Thomas[10] and O. Horneman[11] carried out a series of experiments on pigs analogous to those reported by Weigert in this case, however, determining the immune reactions on young pigs infected with tuberculosis and subjected to various feeding conditions. These observers found that pronounced variation in the feeding had no influence on the complement content or the opsonic index. Both the infected and noninfected animals showed no difference in the complement content. They corroborated the findings of Weigert that high protein feeding retarded the spread of the infection whereas high carbohydrate feeding favored it.

Kleinschmidt[12] studied the antibody formation on young dogs under both natural and artificial conditions. Hemolysis and agglutination

8. Heiman: Monatschr. f. Kinderh. **6**:340, 1907.
9. Kaumheimer, L.: Centralbl. f. Bakteriol. **49**:208, 1909.
10. Thomas, E.: Biochem. Ztschr. **57**:456, 1913.
11. Horneman, O.: Biochem. Ztschr. **57**:473, 1913.
12. Kleinschmidt, H.: Monatschr. f. Kinderh., Ong. **12**:423, 1914.

were the reactions principally determined. He found that neither high carbohydrate nor high fat content of the artificial food influenced antibody formation to any degree. Alimentary disturbances, however, can hinder antibody formation. Marked disturbance of the antibody formation occurring during an alimentary disturbance can quite rapidly be brought back to normal during the repair stage if the animal is placed on natural feeding. During the repair stage, for example, the hemolysis can be practically normal, even if the body development is markedly retarded. Kleinschmidt concludes from his experiments that the constitution of the organism is more important by far for the development of immune reactions than is the type of feeding.

P. T. Müller[13] studied the influence of artificially produced alterations in the metabolism on the production of antibodies. One series of doves was fed on food rich in fat and protein, and a second series on food rich in carbohydrate and deficient in protein and fat. The animals were then subjected to infection with different types of organisms. He could not show definitely that the type of feeding had any consistent influence on antibody production. For some organisms it was marked, for others not. Much seemed to depend on the nature of the micro-organism that was used as the infecting agent.

Trommsdorff[14] studied factors which would tend to reduce the natural resistance of the organism to infection. His work was carried out on guinea-pigs. In connection with the present study his results from the effect of starvation on production of immune bodies are particularly interesting. Trommsdorff comes to the conclusion that starvation has an unfavorable influence on the production of antibodies. Prolonged periods of hunger would, for example, diminish hemolysis or abolish it altogether.

Similar results were found by Bakunin and Boccardi[15] who found the alexin content of the blood of starving dogs and doves reduced or absent. Meltzer and Norris,[16] on the other hand, did not find that the bactericidal faculty of the blood serum of starved dogs was decreased. Rosatzin[17] found no change in this respect in rabbits deprived of food

13. Müller, P. T.: Arch. f. Hyg. **51**:365, 1904.
14. Trommsdorff, R.: Arch. f. Hyg. **59**:1, 1906.
15. Bakunin and Boccardi: Riforma med., No. 183, 1891.
16. Meltzer and Morris: J. Exper. Med. **4**:131, 1899.
17. Rosatzin: In Lubarsch. Zin Lehre von den Geschwulsten in Infect. Krank., Weisbaden, 1899.

and water. Roger and Josue,[18] and Teissier and Guinard[19] observed that withdrawal of food paramount to starvation would at first lessen the animal's organism resistance to infection. If the starvation, however, was not carried to extremes and was continued over a long period, the animals were found to be much more resistant than the control animals.

AUTHOR'S EXPERIMENTS

The work I wish to report was undertaken to show whether there was any difference in the defensive mechanism of hydrated or concentrated tissue, using determinations of immune reactions as an index.

Parallel series of guinea-pigs were taken, as near as possible in age and weight for each series. The animals were kept under the best conditions possible. The preliminary feeding stage covered a considerable period before immunization. In the fat series, the attempt was made to cause increase in weight as rapidly as possible through the use of liberal carbohydrate feeding, particularly maltose. The weight increase occurs rapidly if the pigs are kept under favorable conditions. Some allowance must, of course, be made for normal growth. The lean series of pigs were kept on a balanced ration just sufficient to sustain them. The development of scurvy was prevented by the use of moderate amount of fresh vegetable matter. The weight loss was brought about gradually and, before immunization, generally amounted to from 25 to 35 per cent. of the original body weight. The pigs were sound and active and showed no external evidence of disease. On account of the difficulty at present in obtaining material, the series tested for agglutination was on a shorter preliminary feeding period than the animals used in the other series.

The lysin reaction was compared in fifteen fat animals and eighteen lean animals. The animals were immunized against blood cells by intraperitonal inoculations. About one-fourth c.c. of washed blood cells were injected intraperitoneally at from two to three day intervals. Two weeks following the third or fourth injection the animals were exsanguinated, the blood allowed to clot, and then centrifuged in order to separate the serum from the clot. The serum was then diluted with salt solution 1 : 10, and its lytic titer determined in the

18. Roger and Jossué: Semaine méd., 1900, No. 29, p. 235; Compt rend. Soc. de Biol., **52**:696, 1900.

19. Teissier and Guinard: Semaine méd., 1897, p. 67.

usual way. Objections might be made to this method on the ground that the serum of various guinea-pigs may not have contained the same amount of complement. It is a known fact that complement and amboceptor may replace each other within certain limits. However, it seemed that this was a more accurate method than to inactivate the serum in order to destroy the complement, as in the operation of inactivation, an appreciable quantity of antibodies is destroyed.

The precipitin reaction was carried out on eleven fat and eleven lean animals. The animals were treated with from one-fourth to one-half c.c. of ascitic fluid or human blood serum intraperitoneally as was done with the lysin pigs. The precipitin titer of the serum was then determined by the dilution method.

The agglutination was determined in seven fat and seven lean animals. The procedure was much the same as in the precipitin reaction. Pigs were inoculated intraperitoneally with a twenty-four hour killed culture of the typhoid bacillus. Four injections were made at three or four day intervals. Ten days following the last injection the titer of the serum was determined by the dilution method.

RESULTS

From the accompanying tables it can be seen that the lysin reaction was negative or nearly so in practically all of the fat animals, but was positive, sometimes to a marked degree, in over 60 per cent. of the lean pigs. The precipitin reaction was uniformly negative in both the fat and lean series. For some unaccountable reason the guinea-pig serum does not give the precipitin reaction. This is strange in view of the behavior of the agglutinin reaction, which while present in only 11 per cent. of the fat animals, was positive in over 70 per cent. of the lean animals. To draw far reaching or final conclusions from a study of this kind is surely unwarranted.

If, however, immunity reactions are a good criterion of tissue resistance the rather striking behavior of both the lysin and agglutinin reaction would seem to indicate that there is a difference in favor of concentrated tissue and that the theoretical considerations expressed by Czerny and other observers are substantially correct.

The author wishes to acknowledge the valuable assistance and helpful suggestions of Dr. W. P. Larson of the Department of Bacteriology and Pathology in the University of Minnesota.

DISCUSSION

DR. ABT: It has never been clear to me that there was actual water retention in the cases cited by the essayist. The statement is generally referred to in the literature as an accepted fact, though in my opinion it lacks adequate proof. I would thank Dr. Schlutz if he could clear up the matter for me. It has never been proved.

DR. SCHLUTZ: I hardly know how to answer Dr. Abt's question. In a measure we, of course, assume that there is water retention in these animals. There are ways to prove it, but I did not attempt them. The feeding was high in carbohydrate, and we know that such feeding results in water retention. Many of you are no doubt familiar with the rapid gain in weight often seen in feeding buttermilk to which considerable carbohydrate has been added. The gain in weight is more rapid than could be accounted for by an actual increase in tissue substance. It is assumed, therefore, to be a water retention.

AMERICA'S DEBT TO FRANCE

J. H. MASON KNOX, Jr., M.D. (Baltimore)
PARIS, FRANCE

We hear much today of the debt which France, whose soil is drenched with the blood of her brave sons, and whose material resources have been drained during these years of devastating warfare, owes to the unselfish and gallant aid which American soldiers and civilians are so generously furnishing.

It is indeed an indebtedness gladly acknowledged by the French people of all classes, from the high officials to the lowly *poilu*. With our own shores protected by distance from the successful invasion of the enemy, when it became apparent to our people that the issues at stake were those of democracy versus tyranny, or the right of a free government as opposed to the might of an appressor, our whole nation, with wonderful unanimity, entered into the conflict and is crossing the seas today to put all our resources at the disposal of those countries which heretofore have borne the brunt of the trial and suffering. "What is ours is yours" will be quoted with approval when the war clouds have long since passed away. We are indeed helping France today and glory in it, and will continue to pour into her lap our best treasures until the need is past.

RESPONSIBILITIES OF AMERICA

It is, however, to the other side of the shield that I should like to draw attention, and see if the opportunity which, as a nation, we have grasped so readily to come to France, to accept her hospitality and her good will, may not, both directly and indirectly, be of incalculable advantage to our own people, and if we take part by unselfish and intelligent effort in helping solve the numerous vital problems which press for solution in France at this time, will it not strengthen our hands at home? Will not the endeavor to understand, to assist in meeting the acute needs of the French people, make a stronger, more thoughtful, more efficient race in America? Must not the kindly, almost pathetic confidence with which Americans everywhere in France are today received, carry with it for us great responsibilities which, if bravely borne, will result in higher average capacity for service at

home than ever before? Ought we not to realize the great value of the unique opportunity America has to see, at first hand, this fascinating French civilization and to work hand in hand with the many organized *oeuvres* which are devoting themselves to solving their problems?

Truly, there is much here to see for those who have the vision. There is much experience to be acquired for those who are able to learn and those who have seen the vision and profited by their experience here should be able to see and know the way of efficient service and walk more sturdily in it at home.

PERSONAL OBSERVATIONS

I want to limit my remarks to conditions which have come under my personal observation—those having to do with many phases of infant welfare work that have been developed here in the work of the Department of Civil Affairs, American Red Cross, and particularly of the Children's Bureau. At the outset it must be understood that those of us who are working in this interesting field have great and unaccustomed resources behind us, due to the generosity of the American public. Most of us, physicians, social workers and nurses, have a prestige, as representatives from the great allied republic, which we do not have at home. Both of these unusual circumstances ought to make it possible to accomplish results here which we have perhaps long dreamed of, but have been unable to attain at home.

Let us go over a few of the classic divisions of infant welfare work and see how they are illustrated in various ways by French organizations from which we, as Americans, can learn. And at the same time let us understand in what direction our own efficiency as workers in the field of child welfare could be increased because of the unusual opportunity here.

CARE OF THE EXPECTANT MOTHER

There are, in France, a large number of excellent organizations, offering to women before their children are born, competent obstetric care and instruction and oversight during the first two years of the infant's life. One of the most important of these is "la Mutualité Maternelle," where, for the payment of 3 francs a year, all these benefits can be obtained. This organization has more than fifty consultations in and about Paris and many others throughout France. Each member of the organization receives 12 francs a week for four

weeks after the baby is born, on condition that she abstain from work, and 10 additional francs if she is able to nurse her child. The results obtained are excellent. We have been able to cooperate with many of these *consultations de nourrissons* and in several instances the Children's Bureau has conducted them itself, because the French physicians have been called to military service. It would be possible to return to America, therefore, with first hand knowledge, after a considerable experience with this established and widespread effort to care for the expectant mother, to prevent her overwork, to secure good obstetrics and to encourage the breast feeding of her child.

We are cooperating in a similar manner with other organizations conducting *gouttes de lait* and other consultations, notably those started by Dr. Budin and now conducted by Mme. Budin, herself a trained nurse, in memory of her husband. It may be recalled that all our milk stations at home were patterned more or less after the Budin clinics begun in 1891 and 1892.

NURSES' TRAINING

Perhaps one of the subjects for lively discussion at home is the question of the comparative value of nurses of specialized versus general training in public health work. There is opportunity in Paris to see at close range the results obtained by both groups of nurses. Several of our dispensaries for children and infants are conducted by specialized pediatric nurses, whereas others are health centers in the larger sense of the term, where all ages are treated and the nurses have a general professional and social training. A few months' experience of this kind will help greatly in determining by which group the needs of the infant population can best be reached.

Again, the most effective method of cooperation between dispensaries having to do with the tuberculous and those treating children can be studied well at first hand in Paris. Together with the Rockefeller Foundation for the Study and Relief of Tuberculosis, in one *arrondissement* four dispensaries for both children and patients with active or latent tuberculosis or who have been exposed to it, are under way. It is the object here, not only to remove advanced cases into institutions, but to furnish adequate instruction and nursing supervision in the home, so that the spread of the disease there may be eliminated. With those having this important work in charge, our infant welfare nurses are working hand in hand, and we hope many practical lessons can be learned as the result. All children who have

come in contact with known cases of tuberculosis are kept under frequent observation. Sanitariums and homes in colonies are provided for them where necessary.

SOCIAL SERVICE

In connection with all our dispensaries, social service is emphasized. This, perhaps, is America's principal contribution to the French hospital and outpatient work, although there are several societies here of recognized merit, which have done excellent work for years in this field.

Our aim here has been to assert that intelligent dispensary diagnosis and treatment cannot be successfully carried out without a knowledge on the part of doctor or nurse, or both, of the home conditions under which the patient lives. Very often, when these are found to be directly harmful to health, their correction proves to be all that the patient needs. This is the attitude of a small but growing number of our hospital superintendents and physicians at home, and here in France we have an unusual opportunity to test its value.

We have been particularly fortunate in having for several months Dr. Richard H. Cabot in charge of a large central dispensary, in Paris, where French nurses and aids have received special instruction as to the best methods of social service as applied to dispensary work. The importance of visiting in the home, on the part of nurse or doctor, cannot be overemphasized. We have been able to demonstrate, many times, the great improvement in the health of the dispensary patients who follow suggestions made at their homes by the visitor, as to food, fresh air, and general hygiene, and our Bureau has been able, on the basis of first hand knowledge, and in cases of definite need, to improve housing conditions, to increase the food supply or to increase the ventilation, with very happy results. For the general direction of our Paris dispensary work, our Bureau has been most fortunate in securing the skilled and devoted services of Dr. John B. Manning of Seattle.

WORK IN THE RURAL DISTRICTS

Thus far, in America, the principal effort to reach the baby has been confined to the cities. We have long known that the child in the country needed help. Here in France, particularly in the rural and semi-rural districts, near the war zone, where a considerable civilian population has remained, an exceedingly important work has been organized, to aid the children. Usually our dispensary equipment has

been installed in some center, and from this point, by means of an automobile, carrying doctor and nurse and nurse's aide, the surrounding towns and villages are visited once or twice a week and large clinics held. Sometimes a nurse and an assistant live in one of these centers and spend the time between the doctor's visits in home visiting and in collecting cases for the clinic. Often these dispensaries have been conducted in connection with a central hospital which receives those children which require hospital care. Frequently the arrival of the American doctor and equipment has brought the first medical attention in months to some of these villages. I believe that much the same thing can be done in many of the rural districts at home, where now there is much need. Many cases requiring surgical and other special treatment could be found and helped. I have personally seen, a number of times, the joy with which the arrival of the doctor is welcomed in these small dispensaries. This rural work was begun by Dr. J. P. Sedgwick and continued and much extended by Dr. Maynard Ladd of Boston.

VALUE OF CHANGE OF CLIMATE

We have had, too, in France, a splendid opportunity to observe the value of change of climate in conserving the health of children. For years, the school children of Paris have been moved for part of the summer in so-called vacation colonies to the country—sometimes in groups of children, sometimes with their parents, sometimes to the seashore, sometimes to the mountains—or again sometimes simply to the nearby less crowded communities. All these groups form a basis for interesting study. There is much material at hand as to which kind of climate will most benefit certain conditions.

THE DEPENDENT CHILD

Again, the question of the dependent child can be nowhere better studied than here in France where orphan asylums of all varieties, in the cities, in the country, with industrial training, and without it, abound. Moreover, there are a number of organizations engaged in the intelligent placing of children in colonies in foster homes and elsewhere. Perhaps we, in America, in our politically controlled institutions, have sinned against the dependent child more than in Europe. These unfortunate children are frequently crowded into unhealthy asylums, inadequately fed and taught, and deprived of any semblance

to normal family life. In many of our states, there is no proper supervision of the institutions receiving state appropriation for the care of state wards. On the other hand, the satisfactory results that have been obtained with orphaned children when they are properly cared for and educated, particularly in foster homes, is well known.

The Children's Bureau in France has received appeals for aid from scores of orphanages and asylums. In many instances, the help granted has been conditioned on the installation of improved methods, such as industrial training, with adequate supervision. At times, it has insisted on a system of child placing as a substitute for asylum life. The large number of children orphaned by the war gives the greatest incentive to an agency such as the American Red Cross pledged to the real relief of the civil population of France, to do what it can to assist these unfortunate boys and girls to secure that mode of life and living conditions which will most likely draw out their best qualities, and make of them sturdy, self-supporting citizens.

On a small scale, the American Red Cross has made itself directly responsible for the training and education of a number of war orphans adopted by our American soldiers. These children are placed in carefully supervised homes and given that education best fitted for their capacities. We hope this effort will serve as an example of what should be done on a large scale, not only in France, but in America, for children bereft of parents, and we expect that the future of these American wards will be so satisfactory as to make it necessary to give all dependent children an equal chance.

THE ILLEGITIMATE CHILD

The problem of the unmarried mother and her babe is even more acute in France today than at home. It is being met adequately here, as with us, in only a small number of instances. They are sufficient, however, to prove abundantly the contention that the life of the baby and the future of the mother depend on their remaining together throughout the first year. We are attempting to bring this about by way of example, in certain districts. We hope that in this field the willingness of the French people to follow the suggestion of Americans at this time will lead to a permanent betterment of the condition of this unfortunate group. We recognize here a special responsibility born of power to help, which we must not shirk.

INTENSIVE INFANT WELFARE WORK

One of the most valuable contributions to child welfare work which this American invasion of socially trained doctors and nurses at this critical time in France can make, both in city and rural districts, is the demonstration of methods by which necessary aid can be provided for *every baby* born. This is an ideal toward which many of us have looked impatiently at home. In no community in America has this desired state of affairs been attained. Here in France, with accurate statistics of births and deaths which have been placed at our disposal by the government authorities, there is a golden chance to demonstrate what this kind of thoroughgoing infant welfare work will do in the actual number of lives saved. We have, in several instances, secured lists with the names and addresses of all children born in the quarter of the *arrondissement* in which our dispensaries are situated. We propose, with French nurses and social workers, to visit every baby there, to follow them to the country, if they have left Paris; at any rate, to see to it that they receive adequate care. The same aid will be given in certain rural districts and in certain of the middle-sized towns. We firmly believe that the opportunity is unique to write Q. E. D. concerning the efficiency of a number of methods the efficiency of which, up to the present time, has not been actually proved. We are convinced that one of the most important legacies which we can leave in France, after our return home, is the actual demonstration from the statistical standpoint, of the efficiency of our infant welfare work in certain specified areas. If, through carefully arranged clinics, in connection with thorough social visiting, we can demonstrate a fall in the death rate among infants of 50 per cent., our work must be continued when we leave. In France, as perhaps nowhere else, the value of child life is appreciated, and almost any sacrifice of time and money will be made if practical methods of conserving the children of the nation can be shown.

CONTROL OF INFECTIOUS DISEASE

The control of infectious disease has baffled public health officers and school physicians in America for many years. It is also perplexing in France. Our bureau has a particularly interesting opportunity in this field in having turned over to it the children returning from Germany and Belgium to France through Evian. When the convoys are coming, two arrive each day, each consisting of approximately 600

refugees, from one-third to one-half of whom are children. Many of them have been exposed to the various infectious diseases and the problem of discovering such instances and of separating them from the others is exceedingly complex and difficult. The children are passed by one of our physicians and nurses shortly after they arrive, for a rapid inspection of glands, skin, throat and hair. The patients who are doubtful cases of infection are separated. When infectious disease is discovered, these patients are sent to a large hotel converted into a splendidly equipped hospital for isolation and treatment. After danger of infection is passed, they are either returned to their parents to move on to where they are to be permanently located, or, in certain instances, are sent on to convalescent homes or to other colonies.

In the hospital at Evian, a considerable number of cross-infections are always present, and there is a remarkable opportunity afforded to study the serious infectious diseases incident to childhood. We do not feel that we have solved the problem of preventing the spread of these communicable diseases to other parts of France. To do this would require colonization and isolation at Evian of all children during the period of incubation for the various infectious diseases. This may be advisable in the future, but has not been possible up to the present time. That many such cases are discovered and checked at Evian, and France, to this extent, protected from the spread of these contagions, is certain, and this contribution is greatly appreciated by the French. Certainly any American physician interested in the study of communicable disease should consider himself fortunate to have the opportunity of service at Evian. Dr. C. F. Gelston of San Francisco, has been largely responsible for the efficiency of the service.

TRAINING OF HEALTH NURSES

We realize, of course, that the American contribution to the French situation is largely a question of the development of nurses trained in public health methods. Americans cannot do this work. They can only assist a little in pointing out the way and with this end in view courses, some short, some longer, in the essentials of hygiene and public health nursing for children, have been instituted in connection with several hospitals and dispensaries. These courses have been attended by French women of fine ability, who apparently see the value of this sort of work. The courses have been arranged largely by Miss

Harriet L. Leete, who is well known everywhere in America and who has had long experience in this field.

SCHOOL CANTEENS

In connection with our city dispensaries, the somewhat undernourished condition of many of the children seemed a striking feature. After investigation, it was found that many children received the principal meal of the day at the school canteens, and that this meal had been reduced in quantity because of war conditions. The American Red Cross has been able to add supplementary diet to these canteens in those *arrondissements* where it was most needed and in certain districts also outside of Paris. It has had a most happy result not only in improving the color and strength of the children but in affording an opportunity to demonstrate the good will of the American children in whose name this food was given to the thousands of French children who received it.

In addition to this increased nourishment given through the schools, quantities of food have been placed in the storerooms of several of the *mairies,* to be drawn on by by our physicians and nurses for particular families where they find, after visiting and knowing their needs, that further diet is indicated. These added nourishments, offered under these unusual circumstances, has not only aroused a feeling of gratitude on the part of the French people, but has made possible an interesting study of the effect of diet in supplementing dispensary medical work.

The close connection which we always endeavor to emphasize between relief work for the civil population and the efficiency of the father or brother at the front, is emphasized by a postcard which our nurses carry with them and which is signed by the mother in the home, informing her representative in the fighting line that the American Red Cross nurses will care for their families in case of need.

GOVERNMENT ASSISTANCE

Perhaps no country in the world has such an elaborate system of allocations granted to dependent families, wives and children, dependent on the soldiers at the front. More than a reference to this subject would carry me far afield. There is much, however, which our own people can learn to great advantage from the French practice in this regard.

VALUE OF PROPAGANDA

American methods of propaganda in the field of child welfare have not been extensively employed in France. They seem to be received with unusual favor. General interest is being aroused by them in many parts of the country in all matters pertaining to the welfare of the child.

(*a*) *Exhibits in Large Cities.*—Two general plans are being followed: The organization of large exhibitions in child welfare in several of the large cities is undertaken. These exhibits resemble those we are familiar with in Baltimore, Philadelphia, Chicago, New York and elsewhere, but there is a novelty about them to the French which creates a feverish interest in the part of the attendants unknown at home. The story is told by wall-tablets, pamphlets, models, and driven home by lectures, practical demonstrations and the cinema and what was new in my experience, a very well arranged Punch and Judy show, in which the parents of the baby, after various vicissitudes, learned to care for it properly.

A cinema performance outside the exhibition building at Lyons I saw attended by a thousand people in a driving rain. Some of this interest may be due to the natural curiosity of the Latin race in any new thing, but much of it is real interest in the children of France and expresses a frank appreciation of the proffered help from America.

No one could see these eager people, so willing to adopt our suggestions, without a solemnizing sense of responsibility. Those of us who have aroused this interest must see to it that it is followed by placing at the disposal of every mother needing it, such help as is necessary to properly care for her children. It is difficult to overstate the opportunity which presents itself from this spontaneous popular response. At Lyons, where the first large exhibition is being held, Dr. Clifford G. Grulee of Chicago, who is director for that district, is fully alive to the importance of "follow-up" work, and is securing the cooperation of the various *oeuvres* of the city, and is beginning dispensary and social service work of his own, conducted in large part by French nurses who are taking the special training courses.

(*b*) *Smaller Exhibits in Rural Districts.*—Besides the large exhibition in the larger central cities, smaller exhibits in conjunction with the Rockefeller Commission are planned for the smaller towns and villages. Automobiles, designed to carry the panels and with a dynamo

to run the lights for the cinema, are used. Everywhere, from the officials and people alike, the same cordial welcome awaits the representatives of the Americans in their effort to teach hygiene, as applied in the campaign against tuberculosis and infant mortality. In these smaller places, too, we endeavor to make use of the interest aroused by the organization of permanent activities in child welfare. Certainly the only limit to the lasting aid America can give to the children of France is the dulness of vision and the failure on the part of those of us who are privileged to be here, to grasp and develop this golden opportunity.

THE CARE OF DISPLACED POPULATION

The large number of refugees who are obliged to leave Northern France and seek temporary quarters elsewhere, present many problems in immediate and emergency relief, in which the American Red Cross is able to render splendid cooperative service. More than a million of these unfortunate people are being sent from the danger zone, in large colonies, to nearly all the other departments of France. Here they are met and cared for by sympathetic, intelligent delegates of the Bureau of Refugees and Relief, under Dr. Edward T. Devine of New York. The medical care of these people involves the organization of health centers, often the opening of temporary hospitals and the institution of other first aid measures, which not only greatly relieve the distressed people, but afford a wonderfully valuable experience in relief work to a group of Americans which should fit them, in an unprecedented manner, for effective emergency work of this kind at home.

JUVENILE DELINQUENCY

The amount of juvenile crime has increased greatly in France since the war. This has been true in all wars, when the head of the home has been removed, household discipline lessened and the family income reduced. I understand that the system of juvenile courts which, with probation officers and children's aid societies, have been so helpful in America in detecting early delinquency and in preventing its development, are not operative as yet in France. Here is a wonderfully attractive and useful opportunity for those who have the love of youth and expert knowledge which would yield returns past all computation for the long future.

SOCIAL SETTLEMENT

Some of us imagined that social settlements, as we have known them in England and America, were limited to these countries. We had not been in Paris long before we found several settlement houses fully equipped for social service ministering to needy districts. We have opened dispensaries for women and children in connection with these settlements and are learning at first hand that this form of social service is as useful here as at home. What a chance for a number of trained women to add to the corps and equipment of those who for so many years in comparative obscurity have been doing the pioneer work.

COMMENT

I have enumerated only a few of the things we can do to help this heroic, long suffering nation in the hour of her need, when the very doing of the job will enure to the lasting benefit of our own beloved land. Many of these opportunities have been seen and grasped by the honored Chief of the Children's Bureau, Dr. William Palmer Lucas of San Francisco, whose work it has been my privilege to share.

France has been fighting *our* battle for three long years. Our debt to her can never be paid. She offers us welcome to her shores, to her people; she opens to us her treasure house of statistical information; she presents to America, it often seems, her very soul, to make of it what we will. Surely this is a sacred task, a confidence which we will not abuse. Every one of us who has anything to contribute to the efficiency of our arms, to the comfort and upbuilding of the civilian population of France, must be eagerly willing to be used, assured that whatever of man power, of experience, of heart, of brains, we put into the right side of this world struggle, will not be lost, and more than that—it will live, take root and grow and it may become a tree whose leaves are for the healing of the nations. Only those who have ears to hear will heed this call.

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